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Southern Region

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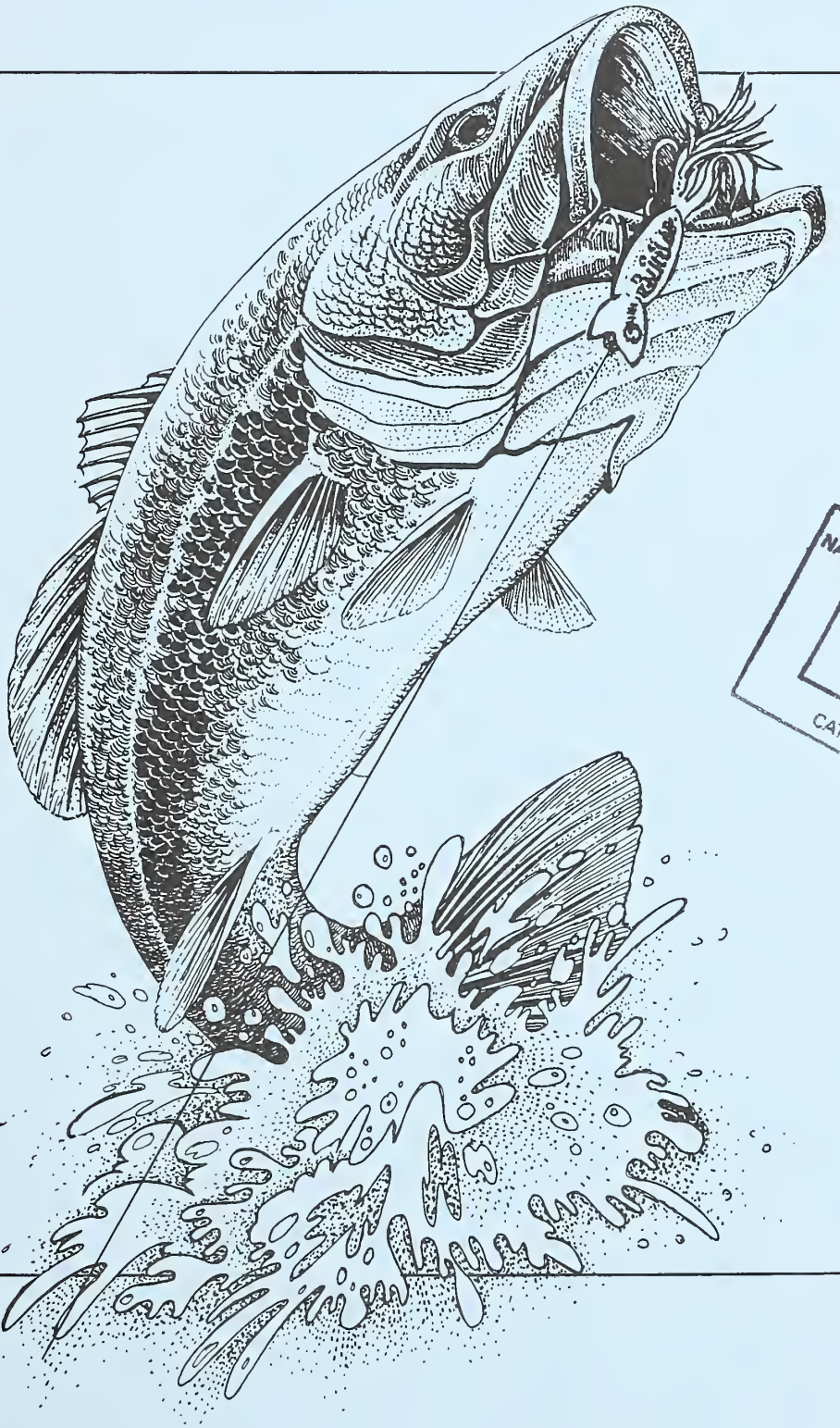
A Guide to Fisheries Program Management on Southern National Forests

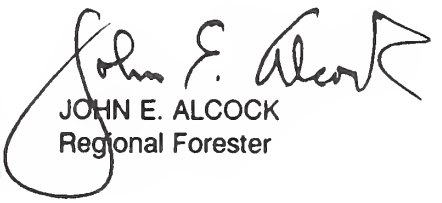


FOREWORD

Since it was first implemented three years ago, "Rise to the Future" has become a national success story. Working closely with our partners, the Forest Service has been very effective in elevating the importance of fisheries management on our national forests and increasing public awareness of the important role the agency has in fisheries managemnent. As a result, a significant amount of effort has been made in improving the quality of fisheries habitat and in increasing fishing opportunities on the forests. Consequently, the Forest Service is now recognized as a leader in fish habitat management.

In the Southern Region, we have made major strides in developing our regional fisheries program under "Rise to the Future." Our fisheries budget has increased substantially and the number of fishery biologists providing expertise to the forests has more than doubled. To ensure that we are able to continue to provide the growing fishing public with a quality fishery resource, it is necessary now that each forest make sure they have a strong, well-balanced fisheries program. Programs should be developed cooperatively with our partners and designed so that they can identify long-term goals and objectives that will best meet the needs of our customers. These programs will demonstrate to the public and our cooperators that we are committed to sound fisheries resource management on our National Forests.

This handbook will serve as a guide for our entry level and mid-career fisheries biologists in the development and implementation of well-balanced fisheries programs on each forest. The topics addressed in the handbook are timely and designed to integrate fisheries management with all resource disciplines. The development of sound, forest-level fisheries programs, as described in this handbook, is essential as we move ahead in the management of our valuable fisheries resources in the Southern Region.



JOHN E. ALCOCK
Regional Forester

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* During the final stages of preparing this handbook, Mr. Lloyd transferred to the Forest Service's Washington Office, where he serves as the National Fisheries Program Manager. Comments on this handbook should be sent to the current Regional Fisheries Program Manager, Danny J. Ebert, address above.

A Guide to Fisheries Program Management on Southern National Forests

Table of Contents

INTRODUCTION

In March 1987, Chief Dale Robertson signed the National Fisheries Action Plan which set in motion the Forest Service's new "Rise to the Future" fisheries program. As a direct result of this new program, budgets have increased substantially, the number of fisheries biologists in the agency has doubled, and projects designed to protect and enhance the aquatic habitats have provided better public fishing opportunities. Also, the Forest Service has enjoyed an increasing number of cooperative programs with newly established partnerships with other agencies and groups. In the past 2-1/2 years, the Forest Service has become a leader in fisheries management and has set the pace for other agencies and groups to follow.

As we enter the second wave of "Rise to the Future," it will be important for each national forest to develop a fisheries program that will identify well-defined goals and objectives along with the necessary coordination and enhancement projects needed to accomplish these goals. These programs are necessary if the direction outlined in the "Rise to the Future" Initiative is to be fully realized at the field level.

The Southern Region manages some of the most unique and diverse aquatic resources in the Forest Service. Over 176,000 acres of lakes and reservoirs lie within the region's forests. More than 14,000 miles of streams and rivers provide important habitat for 470 cold, cool, and warmwater fish species. To effectively manage these resources and to meet the overwhelming public demand for their use, it is essential that the forest biologist not only be the technical expert in fisheries but become the key player in forest fisheries program development.

This guide is intended to help biologists develop fisheries programs throughout the Southern Region. They will find it will serve to help standardize procedures used in managing the aquatic resources. The guide becomes available at a particularly important time because many fisheries biologists on the southern forests are new to the agency or the region. To best meet the needs of the aquatic resources characteristic of all the forests within the Southern Region, the guide draws on the knowledge and experience of a team made up of all the fisheries biologists within the region. The guide will not only assist the fisheries biologist, but it is also designed to help line and staff officers and non-fisheries specialists develop a better understanding of the role of today's forest fisheries biologist.

CHAPTER I
THE FISHERIES BIOLOGIST

The role of the Forest Service's fisheries biologists has changed considerably over the years. Until recently, their responsibilities centered strictly around learning and practicing technical skills characteristic of the field of fishery biology. Few biologists served on a forest's staff. The image portrayed, in many cases, was that of an individual clad in field attire and surrounded by an array of sophisticated equipment that the traditional forester understood vaguely, if at all. Consequently, many biologists never felt really accepted into the agency and seldom felt effective in integrating fisheries into the multiple-use concept of Forest Service management.

The picture began to change in 1987, with the "Rise to the Future" initiative. This highly successful initiative has been effective in increasing the agency's awareness of the importance of a strong program direction in fisheries. It has increased public understanding of the important role the agency has in fisheries management on national forest lands.

As the second wave of the "Rise to the Future" program unfolds, the importance of properly integrating fishery management into the Forest Service structure cannot be overemphasized. This critical step will require that the role of the Forest Service biologist be considerably broader than the image previously described. In addition to being highly skilled in the technical area of fisheries sciences, the fisheries biologist must broaden his/her interest and responsibilities into areas previously not considered as part of the role of the biologist. In short, there are times when the biologist will have to step out of the hip boots and be a program manager, politician, effective communicator, salesperson and evaluator. At a minimum, biologists must possess an understanding of the budget process, forest planning, and NEPA processes. They will also have a working understanding of the resource programs that require the integration of fisheries.

Since the second chance to make a first impression is never granted, it is important that the biologist be viewed from the beginning with the professional respect he or she so rightfully deserves. Obviously, there are times when the biologist has to be dressed for the field. However, this working attire should only underscore his/her role as the technical expert. The biologist must now also attempt to be involved in meetings involving interdisciplinary interactions, budget processes, ranger/staff/family meetings, and should dress and be perceived accordingly.

The responsibilities of biologists who work for the Forest Service are somewhat different than their counterparts in research and State agencies. Forest Service biologists are members of a forest team responsible for managing the national forests for multiple use, of which fisheries is but one of the many resource components. Although the biologist is not responsible for making the actual management decisions, he/she does provide professional recommendations that go into the decision-making process. How well the decision represents the concerns of the aquatic resource depends on the accuracy of the information and how well it is presented to the decision maker by the biologist. Credibility weighs on the level of accuracy. In addition to an understanding of the fisheries resources involved, biologists also need a broad understanding of the other resource activities that they are involved with, and to be sensitive to those program objectives. They also need an accurate understanding of the interactions of land use activities and the aquatic resource he/she represents. The ability of the biologist to present accurate information in a clear and understandable manner is essential if the line officer is to make the best decision possible. It is equally important for the fisheries biologist to communicate effectively, internally. Internal communication with other Forest Service personnel instills trust and increases awareness and understanding of program objectives and resource needs. An individual may be doing an excellent job, but unless he/she is perceived by others as doing an excellent job, full personal benefit may not necessarily be appreciated. Internal communication can occur in the form of ranger/staff meetings, regional biologist workshops, written reports, informal briefings and one-on-one conversations. For additional information on internal marketing, please refer to chapter VII.

More than ever before, there are increasing career opportunities available for fisheries biologists to obtain leadership and upper level management positions in the Forest Service. By understanding the mission or direction of the Forest Service instead of being solely concerned about individual programs or resources, the biologist can visualize and prioritize goals to meet the needs of the agency, the fisheries program and personal career objectives.

The majority of biologists, like most other resource specialists, decided on the field of biology as a career because of their desire to work in the field. Very few went into fisheries to become line officers or upper level

managers. However, they should realize early in their careers that they may later elect to branch out of the strictly biological arena. It is to the benefit of the individual to become aware of the various long-range opportunities that are available to them and take advantage of training and experiences that are necessary to achieve their goals. They should be flexible in establishing their long-term career goals because opportunities and personal desires characteristically change. It is the responsibility of each individual to obtain the necessary training needed to stay current in fisheries sciences as well as prepared for future career aspirations. Biologists have tended to limit themselves primarily to technical training in their field. However, developing people skills and obtaining managerial training are important aspects of being an effective manager. Formal and informal courses are available for updating technical abilities and developing managerial skills. A list of current courses are made available each year and should be utilized. On-the-job training in the form of special projects, work assignments or details are also beneficial.

As the fisheries programs in the Forest Service develop, their levels of success rest largely on the shoulders of the biologists themselves. Developing effective programs designed to protect and enhance the resource and meet fishing demands is just the beginning. Biologists will have to work with other resource specialists, managers and outside partners in selling the programs, implementing them and evaluating their effectiveness.

The Forest Service is striving to develop new and innovative ways of managing the fishery resources to effectively meet the ever-increasing public demand for quality fishing on national forests. It is essential that the fisheries biologist become a key player in helping the forests meet this important responsibility. Never before has the role of the biologist as a team player been so important. As the expert in fishery biology, coupled with the responsibility of providing vision through program development, the fisheries biologist has the opportunity to make a substantial contribution to the overall management of our national forests.

CHAPTER II
PERTINENT LEGAL POLICY

INTRODUCTION

The Forest Service is administered through the U.S. Department of Agriculture which is part of the executive branch of the U.S. Government. The largest unit of the Forest Service is the National Forest System, which manages more than 159 national forests and grasslands covering almost 200 million acres in the United States, including Puerto Rico. The Forest Service mission statement is "Caring for the Land and Serving People." A number of laws either directly or indirectly dictate how the Forest Service is to manage fish and wildlife resources. The list below describes the major laws and some references for finding more information about them. The laws are listed chronologically with a summary of each one as found (except for the 1984 reference) in the brochure, *What the Forest Service Does* (FS-20).

PERTINENT LAWS

1891: Creative Act of March 3, 1891 (16 U.S.C. 471)

Authorized the President to establish forest reserves from forest and range lands in the public domain. (Repealed by provisions of the Federal Land Policy and Management Act of 1976.)

1897: Organic Administration Act of June 4, 1897 (16 U.S.C. 473-478, 479, 482, 551)

Established the purpose and intent for the protection and management of the lands set aside and reserved as Forest Reserves. Provides for the right of entry to persons for prospecting, locating, and developing mineral resources, and for the use of water and timber resources on forest reserves.

1905: Transfer Act of February 1, 1905 (16 U.S.C. 472, 524, 554)

Transferred the forest reserves created by the 1891 Act and the authority to execute the laws pertaining to their management and protection from the Department of the Interior to the Department of Agriculture and established the Forest Service. Resulted in renaming the forest reserves as national forests.

1908: Twenty-Five Percent Payments to States Act of May 23,1908 (16 U.S.C.500)

Directs that 25 percent of all moneys received for goods and services rom each national forest be paid annually to the States in which the national forest is situated, for the benefit of the public schools and roads of the counties in which the national forest is located.

1911: Weeks Law-Act of March 1, 1911 (16 U.S.C. 480, 515, 517, 521, 552, 563)

Authorizes the acquisition of lands, by purchase or exchange, to be administered as national forest lands for timber production and watershed protection.

1924: Clarke-McNary Act of June 7, 1924 (16 U.S.C. 472, 499, 505, 568, 570)

Directs the Secretary of Agriculture to cooperate with the States in promoting systems of fire prevention, conservation, reforestation, and forestry education for land suitable for the production of water and forest resources. (Portions of this act were repealed by the Cooperative Forestry Assistance Act of 1978.)

1930: Knutson-Vandenburg Act of June 9, 1930 (16 U.S.C. 576 576b)

Requires purchasers of national forest timber to deposit money, in addition to timber stumpage payments, to cover costs to the United States of replanting harvested areas and removing undesirable trees from those areas and to establish forest tree nurseries. Amended in 976 to broaden the uses of the collected moneys, particularly for protection and improvement of future productivity of the forest resources. This act provides a

significant amount of funding for wildlife and fisheries habitat improvement work.

1937: Bankhead-Jones Farm Tenant Act of July 22, 1937 (7 U.S.C. 1010-1012)

Provides for development of a national land conservation and land utilization program for management of acquired lands, and provides for the sale or exchange of acquired lands. (Some of the lands acquired under this Act subsequently became the national grasslands.)

1950: Dingell-Johnson Act

In 1950, the Dingell-Johnson Act (formally titled the Federal Aid in Sport Fish Restoration Act) was passed as a cooperative effort involving Federal and State government agencies. It was designed to increase sport fishing and boating opportunities through the wise investment of anglers' and boaters' tax dollars in State sport fishery development projects.

1960: Multiple-Use Sustained-Yield Act of June 12, 1960 (16 U.S.C. 528-531)

Supplements the purpose for which the national forests were established to include outdoor recreation, watershed, range, timber, and wildlife and fish purposes. Directed that the renewable surface resources be managed to achieve a sustaining yield without impairment of the land's productivity.

1962: McIntire-Stennis Act of October 10, 1962 (16 U.S.C. 582a, 582a1-582a7)

Makes funds available to States on a matching basis to help carry out forestry research at land grant institutions and State-supported forestry schools.

1964: Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136)

Enabled Congress to establish certain areas to be included in the National Wilderness Preservation System. The nucleus of the system in 1964 was the 9 million acres of Federal lands administered by the Forest Service as wilderness and wild areas. Some of these have been managed as such since 1924. The Act provided for studies on the inclusion of additional wildernesses.

1964: Land and Water Conservation Fund Act of September 3, 1964 (16 U S C. 4601-4 — 4601-6, 4601-6a, 4601-7 — 4601-11, 23 U.S.C. 120)

Establishes a system of financing Federal grants to States for recreation, planning, and development. The Forest Service and other Federal agencies were authorized to purchase lands and water areas primarily suited to recreational development. Funds were to be derived from motorboat fuel taxes, admission and use fees in national park and national forest areas, and surplus property sales.

1964: National Forest Roads and Trails Act of October 13, 1964 (16 U.S.C. t32-538)

Provides for the construction and maintenance of a roads and trails system to enable protection and management of national forest land.

1968: National Trails System Act of October 2, 1968 (16 U.S.C. 1241-1249)

Established a national system of recreational and scenic trails, and designated the Appalachian and Pacific Crest Trails as initial components in the system. Provided for studies of other national recreational and national scenic trails.

1968: Wild and Scenic Rivers Act of October 2, 1968 (16 U.S.C. 1271-1287)

Designates certain rivers in the nation as having outstanding scenic, geologic, recreational, cultural, or other attributes meriting their retention in a free-flowing condition, through protected corridors. Also provided for the study of other rivers.

1970: National Environmental Policy Act of 1969 (Act of January 1, 1970) (42 U.S.C. 4321, 4331-4335, 4341-4347)

Declares the enhancement of harmony between people and their environment to be a national policy, and established a Council on Environmental Quality. Requires all Federal agencies to

prepare reports on the environmental impacts of major planned programs or actions by the agency and to describe alternative actions.

1970: Youth Conservation Corps Acts of August 13, 1970 (16 U.S C. 1701-1706)

Provides for the summer employment of youths 15 through 18 years of age. The youths so enrolled were to be employed for conserving, developing, preserving, or maintaining public lands administered by the Departments of the Interior and Agriculture, and by the States

1972: Volunteers in the National Forests Act of May 18, 1972 (16 U.S C. 558a-558d)

Provides for the recruitment and training of individuals to perform volunteer work supporting Forest Service programs and activities without compensation.

1973: Endangered Species Act of December 28, 1973 (16 U.S.C. 1531-1542)

Provides for the protection and conservation of threatened and endangered fish, wildlife, and plant species.

1974: Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (16 U.S.C. 1600-1614)

A planning and budgetary procedure that requires the Forest Service to prepare long-range assessments of the nation's forest and rangeland resources and develop programs for the National Forest System, Research, and State and Private Forestry. Programs for 1975 and 1980 from the Secretary of Agriculture were based on assessments of present and anticipated supply and demand needs and inventories of present and potential resource opportunities. Annual reports on Forest Service programs are to be made to Congress.

1974: Sikes Act of October 18, 1974 (16 U.S.C. 670g, 670h, 670o)

Provides for cooperative programs between the States and the Departments of Agriculture and the Interior to plan, develop, maintain, and coordinate programs for the conservation and rehabilitation of wildlife, fish, and game.

1976: Federal Land Policy and Management Act of October 21, 1976 (43 U.S. C. 1701, 1702, 1712, 1714-1717, 1719, 1732b, 1740, 1744, 1745, 1751-1753, 1761, 1763-1771, 1781, 1782; 7 U.S.C. 1212a; 16 U.S.C. 478a, 1338a)

Provides organic authority for the management of public lands by the Secretary of the Interior, prescribing detailed management direction in such areas as land-use planning, land acquisition and disposal withdrawals, range management, and rights-of-way. The act also provides statutory authorities for the Secretaries of Agriculture and the Interior in range management, issuance of rights-of way, and certain other miscellaneous aspects of management of lands by the Forest Service and the Bureau of Land Management.

1976: National Forest Management Act of October 22, 1976 (16 U S.C. 472a, 476, 500, 513-516, 518, 521b, 528 (note), 576b, 594-2 (note). 1600 (note), 1601 (note), 1600-1602, 1604, 1606, 1608-1614)

Amends the Forest and Rangeland Renewable Resources Planning Act of 1974 to provide for new timber management authorities and a coordinated land management planning process. The act requires full public participation in the development and revision of land management plans for the National Forest System. The act also provides comprehensive new authorities to manage, sell, and harvest national forest timber; statutory protection for national forests created from the public domain; for bidding on National Forest timber; for road building associated with timber harvesting; for reforestation, salvage sales, use of Knutzen Vandenberg funds for benefitting fish and wildlife, and the handling of receipts from timber sales activities. The land management plan is the key document when it comes to managing the resources on the forest.

1978: Forest and Rangeland Renewable Resources Research Act of June 30, 1978 (16 U.S.C. 1600 (note), 1641 (note), 1641-1647

Authorizes a forestry research program in resource management, environmental protection,

forest products utilization, and resource assessment. Updates and expands the authority for forestry research provided originally by the McSweeney-McNary Act of 1928, which was repealed.

1978: Public Rangelands Improvement Act of October 25, 1978 (43 U.S.C. 1751-1753, 1901-1908; 16 U.S.C. 1333b)

Amends the Federal Land Policy and Management Act of 1976 and the Wild Horse and Burros Protection Act of 1971 to provide additional direction and authorities to manage public rangelands. Establishes a statutory grazing fee formula in 16 western States for the years 1979-85, excluding the national grasslands.

1984: Wallop-Breaux Amendment

Amends the Dingell-Johnson Act. Anglers and boaters are now responsible for payment of fishing-tackle excise taxes, motorboat fuel taxes and import duties on tackle and boats. This money is collected by the sport fishing industry, deposited into the Department of Treasury's Wallop-Breaux Trust Fund, and allocated the following year to the State fishery agencies. States use the funds for projects designed to increase boating access and fishing opportunities. All projects must have prior approval from the USDI Fish and Wildlife Service.

SUMMARY

The primary source of information for these laws is Agriculture Handbook No 453, *The Principal Laws Relating to Forest Service Activities*. This handbook includes summaries and amendments rather than the original law which might cause some confusion in deciphering the original intent of the act in question. Other key sources of information include the forest land management plans and the various Forest Service manuals which are maintained by the section which is governed by the manual (i.e., the manual on K - V funds can usually be found in the Budget and Finance section while Law Enforcement has information on the Sikes Act).

Biologists should also acquaint themselves with the content of several courses offered on topics such as writing environmental documents. Such documents have an important part of complying with NEPA. Some good basic information on the structure of the Forest Service can be found in FS-362, *Welcome to the Forest Service - Guidebook for New Employees*.

CHAPTER III
ENDANGERED, THREATENED, PROPOSED AND SENSITIVE SPECIES

INTRODUCTION

The Endangered Species Act became law in 1973. Subsequent amendments have clarified and strengthened the authority of Federal agencies, including the USDA Forest Service, to conserve species proposed for listing, endangered, proposed, threatened and sensitive (PETS) fish, wildlife and plants. The Forest Service must ensure that any action authorized, funded or carried out by the Forest Service is not likely to jeopardize the continued existence of listed species or adversely affect critical habitat. Concurrently with the National Environmental Policy Act (NEPA) environmental analysis process, biological evaluations (BE) are conducted to determine possible effects of the proposed action on PETS species (FSM 2670). If an action may affect a species, formal consultation with the U.S. Fish and Wildlife Service is required under Section 7 of the Endangered Species Act. If a biological determination of "not likely to adversely affect" is made, U.S. Fish and Wildlife Service concurrence is required. A determination of "no effect" does not require Fish and Wildlife Service review.

Regional Foresters have the responsibility to establish lists of sensitive species. These are plant and animal species for which population viability is a concern to the Forest Service due to a significant current or predicted downward trend in numbers or habitat capability. Sources for such information includes U.S. Fish and Wildlife Service candidate species and official State lists of threatened or endangered species and State natural heritage working lists. Other sources may also be used. As with PETS species, BE's are conducted to determine the effects of proposed actions on sensitive species, but formal consultation with, and concurrence of, U.S. Fish and Wildlife Service are not required.

IDENTIFICATION AND RECOVERY

Each forest has a mandate to maintain as a minimum, viable populations of all native and desired nonnative animal and plant species. By compiling and updating the fisheries database, the most accurate information on the distribution, status and trends for all aquatic PETS populations will be established on the forest. These data will enable the development and implementation of management practices to ensure that species do not become PETS, while providing a means for monitoring the recovery of other PETS species.

The recovery of PETS species and habitat restoration is a top priority of the Forest Service. The fisheries biologist must know the distribution of all PETS species and their habitats, not only on the Forest but downstream of the Forest, where impacts from resource activities may occur.

Frequently, little ecology and life history information is available for aquatic PETS species. The fisheries biologist must seek out the experts and glean information about the reaction of a species to typical impacts from resource activities. If experts cannot provide a complete assessment, the biologist, as an interim approach, should evaluate a surrogate species that is taxonomically similar to the PETS species being evaluated. Preferred spawning sites, food organisms and habitat conditions of a more common species may be helpful in determining the potential adverse effects on the PETS species. Research should be contracted with appropriate institutions to establish distributions, ecological needs and life history of PETS species.

Each PETS species that occurs on Forest Service lands requires a recovery strategy, i.e., a written strategy to implement the Forest Service portion of recovery objectives identified in an approved U.S. Fish and Wildlife Service recovery plan or to implement interim forest objectives in the absence of an approved recovery plan. Recovery objectives are given in quantifiable measurements such as number of managed streams. Each year the number of streams managed as habitat for each PETS species is reported to the Washington Office.

BIOLOGICAL EVALUATIONS/ ASSESSMENTS

Biological evaluations (BE) or biological assessments (BA) should be conducted as part of the environmental analysis process and the determinations of effect must be documented in the decision document. An action that is categorically excluded from the NEPA process must still comply with the Endangered Species Act, and a BE must be completed.

A biological assessment identifies the potential effects of an action on listed and proposed species, and

must be done for "major activities". These are "construction projects, or other undertakings having similar physical impacts, which are major Federal actions significantly affecting the quality of the human environment as referred to in NEPA."

A biological evaluation is a Forest Service-required evaluation of a Forest Service program or actively planned, funded, executed or permitted for possible effects on listed, proposed and sensitive species. It is essentially the same as a BA, and is done when a BA is not required. During the initial scoping session for a resource activity proposal, the fisheries biologist should review the available information on aquatic species within the impact area of the project.

The adequacy of inventories for PETS species and their habitat in a project area should be assessed. This should be based on the likelihood of species occurrence or habitat need for species recovery or viability, versus the likelihood of adverse effects from the project. If there is inadequate inventory evidence of PETS species or their habitat within the impact area or the proposed activity will be a high impact, then the fisheries biologist should make a field reconnaissance. During field reconnaissance the biologist should look for evidence of the PETS species, suitable habitat and the magnitude of impact from the resource activity. If no PETS species or suitable habitat are found and the area is not needed for recovery, the biologist should document the details of the field reconnaissance. The biologist should then incorporate the statement "No PETS species, or PETS species' habitat is known or likely to occur in the project area, and the project area is not needed for PETS species recovery, or to meet viability objectives for sensitive species," into the NEPA document.

When PETS species or their suitable habitat is identified within a project area, the biologist should use the following nine-point procedure:

1. **Species.** List the common and scientific names of all PETS species.

2. **Program.** Describe the proposed resource activity, such as: timber sale, land exchange, mineral exploration, etc.

3. **Location.** Give the county, state, forest, district, legal description and, if appropriate, compartment and stand numbers.

4. **Status of Species and Habitat in Project Area.** Describe the aquatic environment and the downstream habitat as it relates to the PETS species. The description should include: qualitative and quantitative habitat characteristics; trends (up, down, static or unknown) for habitat and populations; date of last survey and results; known or suspected limiting factors; and status of the habitat (critical, essential or no designation).

5. **Proposed Action.** The proposed action should still be one of several alternatives since the BE will aid the decision made in selecting a preferred alternative. Use the Purpose and Need section and Alternatives section to describe the action objectives, dates to be conducted and a brief description of the existing situation that may have a bearing on the determination of the effect.

6. **Other Activities.** Describe other activities that are occurring within the watershed, looking toward potential cumulative effects.

7. **Effect on Species and Habitat.** Discuss all impacts (known, judged, or may occur) to the species and its habitat. Qualify and quantify both direct and indirect impacts. Be sure to address downstream factors and cumulative effects (see FSM 2670 for Endangered Species Act interpretation of cumulative effects).

8. **Consultation with others and References.** Contact U.S. Fish and Wildlife Service State fisheries agencies, State heritage program, other Forest Service fisheries biologists and recognized experts. Review relevant documents such as the recovery plans, theses and field guides.

9. **Determination of Effect.** A determination of either the proposed project "will not affect", "is not likely to adversely affect" or "may affect" should be made for each PETS species.

If the determination is "Not likely to adversely affect" a listed species, U.S. Fish and Wildlife Service concurrence is required. Formal consultation is required if a "may affect" determination is made. Formal consultation is to be requested by the Regional Forester. Figure 1 is an example of a biological evaluation.

Figure l.—Example of a biological evaluation.

United States Department of Agriculture — Forest Service — CNF

Reply To: 2670 Date: June 14,1988

Subject: Biological Evaluation for Citico Creek Compartments 8 and 404

To: District Ranger, Tellico

In Compliance with Section 7 of the Endangered Species Act of 1973, I have conducted the following biological evaluation:

1. Species — Smokey madtom-*Noturus baileyi;* yellowfin madtom-*Noturus flavi-pinnis;* spotfin chub-*Hybopsis monacha;* yellow blossom pearly mussel-*Epioblasma (=Dysnomia) Florentina florentina*

2. Program — Timber Sale

3. Location — Monroe County, Tennessee
Tellico Ranger District,
Cherokee National Forest
35°29'N, 84° 7'W
Compartment 8, Stand 12;
Compartment 404, Stands 18, 20.

4. Status of Species and Habitat in Project Area

Smoky Madtom

The smoky madtom is listed as a Federally Endangered species The only known population is located in Citico Creek; critical habitat has been defined on 6.5 miles of this stream. The gradient of the stream in this reach is 0.3%; the substrate consists of bedrock or gravel and cobbles. Preferred habitat is shallow pools and riffles with flat cobbles.

The population trend appears to be stable.Surveys are conducted each year by Dr. David Etnier Eggs are collected for propagation and introduction into Abrams Creek.

Factors limiting the population include siltation of the stream bottom, pH and other chemical variations, and disturbance of cover rocks by recreational "dam" builders.

- - - continued - - -

Figure l.—Example of a biological evaluation, continued

Yellowfin Madtom

The yellowfin madtom is listed as a Federally threatened species.Six populations have been identified; three populations are known to have been extirpated, and three still exist. The Powell River and Copper Creek populations appear to be declining. The Citico Creek population is in the most favorable condition; however, the distribution is extremely restricted within this drainage. The habitat occupied by the Yellowfin Madtom is within the defined critical habitat for the smoky madtom. The yellowfin has been collected most frequently from pools or quiet backwaters unlike the smoky madtom, which is usually taken in riffles or shallow pools. The population of yellowfin madtoms in Citico Creek appears to be stable. As with the smoky madtom, population estimates are made during egg collection by Dr. Etnier. Factors limiting this population are the same as for the smoky madtom. Critical habitat has not been defined within Citico Creek.

Spotfin Chub

The spotfin chub is listed as a Federally threatened species It is known historically from Citico Creek, but has not been there since 1940. The individuals collected may have moved upstream from the Little Tennessee River. Extirpation from this latter stream may have been the result of a change in water temperature associated with dam operations, or by inundation from water.Citico Creek is not critical habitat.

Yellow Blossom Pearly Mussel

The yellow blossom pearly mussel is listed as a Federally endangered species. It is known historically from Citico Creek but has not been collected there since 1957. The species may be extinct. The yellow blossom pearly mussel lives in riffles and is depend ent on clean water. Turbidity and siltation may have led to the decline of this species. No critical habitat has been defined.

5. Proposed Action

The proposed timber sale is in Compartments 8 and 404 (see attached map). The forest types include shortleaf and Virginia pine with a condition class of mature sawtimber. Three stands covering 119 acres will be clearcut to yield 65,000 board feet of timber. Removal will be by tractor logging. The silvicultural treatment will be prescribed burning and planting improved shortleaf pine. Herbicide injection will be used to remove competing hardwoods not killed by the fire. Roads will be constructed for 0.2 miles and reconstructed for 1.75 miles. After completion of the timber sale, these roads will be closed, ripped and seeded.

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Figure l.—Example of a biological evaluation, continued.

6. Other Activities

No other timber activities are currently active within the Citico Creek watershed. Recreational activities include driving, fishing, camping and hiking within this watershed. A large portion of the watershed is wilderness and there are no land tracts above the critical habitat.

7. Effect on Species and Habitat

No direct impacts will occur to Citico Creek, the four threatened or endangered species or their habitats. Potential indirect effects include herbicide pollution and increased turbidity and siltation. Buffer strips separating the active cutting areas from perennial and intermittent channels will contain all coarse sediments that are disturbed. Most fine sediments will be filtered out by these strips. Road construction and reconstruction will not cross any perennial or intermittent channels; minimal sediments derived from roading will reach Citico Creek. Herbicides will not get into stream channels because treatment will be limited to individual tree injection. No cumulative effects are expected.

8. Consultation with Others and References

Informal consultations with: Jim Widlak, USDI Fish and Wildlife Service; Ron Escano, USDA Forest Service, Regional T & E Specialist; Betsy Bunting, Tennessee Department of Conservation; Dr. David Etnier, University of Tennessee at Knoxville.

Recovery Plans for yellowfin madtom, smoky madtom, spotfin chub, and yellow blossom pearly mussel.

"Management Plan for the Yellowfin and Smoky Madtoms in Citico Creek, Monroe County, Tennessee." 1984.

9. Determination of Effect

This proposed project will have no effect on the endangered smoky madtom, threatened yellowfin madtom, threatened spotfin chub, and endangered yellow blossom pearly mussel. No other threatened, endangered, proposed or sensitive species are found in the project area. Formal consultation with the USDI Fish and Wildlife Service is not required.

/s/J.Herrig
JIM HERRIG
Zone Fisheries Biologist

CHAPTER IV
FOREST SERVICE RESEARCH

INTRODUCTION

The Forest Service's principal research is carried out in a separate branch directed by the Deputy Chief for Research. The research is divided among eight forest experiment stations located throughout the country, and a Forest Products Laboratory in Madison, WI. Several field units report to each forest experiment station. In rank, the station director is equivalent to a regional forester. Objectives of Forest Service research are to:

1. Acquire knowledge and understanding of fundamental processes and relationships within the forests and rangelands.

2. Discover and develop principles necessary for wise management, use, and protection of products, amenities, and values derived from forests and rangelands.

3. Disseminate results in appropriate forms and in a timely manner to all potential clients (FSM 4020).

In order to achieve its research program objectives, the Forest Service will "conduct or support research only in research work units that have been approved by a station director" except as authorized by the Deputy Chief for Research (FSM 4030.2).

This should not be seen as precluding Forest fisheries biologists from conducting research, but the scale and duration of this research should be confined to site-specific management problems or concerns. Examples are administrative studies, pilot project studies and site-specific impact analyses.

FOREST EXPERIMENT STATIONS

Each forest experiment station has a mission statement, with more specific mission statements for each of the field units. Field units are chartered for 5-year periods to do research outlined in a series of charter documents that take on the semblance of a contract. These charters are generally circulated for peer review and comment by the research community and appropriate Forest Service regional office staff officers.

Field units are generally subdivided into a series of one or more project units, each of which has a research work-unit description. For example: The Southeastern Forest Experiment Station's Coldwater Research Unit at Virginia Polytechnic Institute and State University, Blacksburg, VA, has the mission to "determine the factors that influence the distribution, abundance, and productivity of trout in southern Appalachian streams." This unit is supervised by the Wildlife Unit, Clemson, SC, which reports to the station director in Asheville, NC. There is also a warmwater research work unit located at the Oxford, MS Forest Hydrology Laboratory that is a unit of the Southern Forest Experiment Station, New Orleans, LA. Other fisheries research work units are located throughout the country, each specializing in regional research topics. The Forest Service Organizational Directory contains the organization hierarchy, locations, phone numbers, and other pertinent information about the research branch.

Forest Service research is separated from the National Forest System, and conducts research on all forests and rangelands, not just national forest lands. Close working relations are maintained with the regional offices. Forest-identified concerns and research proposals are routinely requested by the regional offices and proposed to the experiment stations when research work unit descriptions are being developed.

Informal contacts are also encouraged between management and research organizations. Research personnel help provide contacts within the research community to address local concerns and questions, and provide assistance in study design. The research units are also a potential source of speakers for Forest workshops in specific resource areas and may provide assistance in recruitment. Conversely, national forest personnel provide information on potential study sites, identify rising forest and rangeland issues in need of research, identify potential research cooperators, and may supply some project funding.

RESEARCH ON THE NATIONAL FORESTS

Research on the national forests is certainly not limited to that conducted by the forest experiment stations. In fact, the research natural area program was established to protect undisturbed forest types for a variety of research opportunities on the national forests.

Many opportunities exist to conduct research on site-specific problems, particularly if there are universities or colleges nearby that are competent in those subjects, and interested. Professors are often looking for study opportunities for graduate or undergraduate students. These investigations are generally short term (1 semester to 2 years in duration), but can be expanded. Work-study or cooperative programs offer potential for local research and can lead to professional placement of the student. Working through State fisheries agencies and universities with U.S. Fish and Wildlife Service cooperative research units provides many opportunities for research solutions to management questions. Use of such cooperative ventures reduces the research cost to all and focuses attention to broader and more complex objectives. The Forest Service role will vary depending upon available resources and funding levels.

While Forest fisheries biologists generally lack the time to conduct extensive research, opportunities do exist to conduct limited research by parceling out tasks (generally, data collection) to field personnel or volunteers, or by contracting portions of a project to minimize biologist involvement. Before undertaking a research project, the biologist should research the topic through INFOSOUTH and the Fish and Wildlife Reference Service, as well as discuss the topic with fellow biologists, and the Forest Service research specialists in the proposed field of study.

SUMMARY

The Forest Service does have an organization committed to research on forest and rangelands that can certainly be of assistance in conducting broad scale research and providing technical expertise. The regional and supervisors' offices should work closely with their respective forest experiment stations to coordinate their research needs. For short duration, site-specific research, the biologist needs to be creative in solving research needs. State fish and game agencies, State heritage programs, fish and wildlife cooperative research units, colleges and universities and public organizations are other potential sources of assistance to the fisheries biologist in developing, funding and completing needed research.

CHAPTER V
COORDINATION

INTRODUCTION

The Forest Service's fisheries resources are managed to meet these principal goals: to protect, enhance, and restore the aquatic habitats. Coordination is important in fulfilling our protection responsibilities. Current fisheries work and future plans should be clearly understood by those responsible for other functions on the forest, other administrative levels within the Forest Service, other forests, State agencies, and other entities outside the Forest Service. In addition, good coordination involves efforts to welcome feedback and suggestions of others affected by our work and future plans. Good coordination is one of the most important responsibilities of the fisheries biologist. It is imperative that fisheries biologists develop a personal rapport with key individuals in each affected organization to foster an open line of communication. To do so encourages an unrestrained exchange of ideas and opinions which can remove impediments and promote the all-important feeling of propriety in the forest fisheries program.

GOOD BUSINESS PRINCIPLES

Employ these principles of the business community: The three most important elements of successful negotiation are knowledge, power, and timing. These elements are perhaps of equal importance to fisheries biologists who are assigned the task of negotiating increased emphasis on fisheries on their forest.

Knowledge. The fisheries biologist is not always comfortable with his/her knowledge of certain fisheries-related subjects, especially those dealing with cause-and-effect phenomena. Close coordination with other fisheries specialists from the Forest Service, universities, and other natural resource agencies will ensure that the forest fisheries biologist is the best source of fisheries information on the forest staff. As a technical specialist, the fisheries biologist is an advisor to the forest supervisor during the decision making process.

Power. The form of power in this business triangle comes from the public demand for the use of the resource itself—the angler or consumer. It also comes from the fisheries scientific community that is interested in healthy populations and their habitats for all fish species. With 60 million anglers in the country today and countless professional/nonprofessional organizations and fishing groups, public demands are substantial. The fisheries biologist must establish and keep up contacts with existing angler groups and coordinate fisheries activities with them. Emphasis should be placed on convincing these groups that their input will be heard, and that they can influence decisions. Educating the groups as to how to make their views known to the forest supervisor is another task that should be undertaken by the biologist.

Timing. The fisheries biologist has control of this element through program development. The key is to be proactive rather than reactive. To be proactive, include a fisheries section in the forest land and resource management plan (LMP). This section should state definitive fisheries resource management standards and guides, and priorities and concerns. Include fisheries program goals, objectives and potential project plans. Development of this plan should be a comprehensive exercise in internal and external coordination.

INTERNAL COORDINATION

In fulfilling its important role as a multi-use land management agency, the Forest Service has the overwhelming task of integrating the various resource activities to best meet the needs of all involved resources and publics. To most effectively help the forests meet the needs of aquatic resources during project implementation, fisheries biologists must ensure that they're involved in the interdisciplinary team process for all activities that may affect fisheries resources. They can thereby assure that LMP standards and guidelines are followed. It is important that the biologist's perspective reaches the line officers; it gives them the information needed for making the proper decisions.

To be helpful, the biologist must be involved. In setting up the annual work schedule, the biologist should become familiar with scheduled forest activities that could involve fisheries resources. It is also important for the biologist to ensure that the various resource specialists/managers understand how the biologist can be helpful, what resource concerns may exist and what informa-

tion the biologist will provide during the review process.

Lakes, ponds and streams and their associated riparian zones generally make up less than 5 percent of the total land base of a national forest. Because of their unique qualities; however, these areas are frequently in the center of controversy over the demands for their use. Water-related recreational activities attract many people. Stream courses generally provide the most cost-effective and direct avenues for transportation corridors, and greater timber volumes can be found associated with these wetter sites. The lush vegetation and source of water attracts livestock and wildlife. Care must be taken in establishing management direction for these valuable areas so that the needs of riparian/water-related resources are met. The fisheries biologist is an important player in ensuring that this important step is completed.

Providing proper fisheries input into the NEPA process is essential. First, it ensures that the needs of the aquatic resource are identified and incorporated into the decision-making process. Secondly, it helps to sensitize non-biologists on the value of the fisheries involved, to better understand habitat and population needs and to support fisheries resource objectives. Finally, it helps the biologist become more effective as a team player. The latter not only helps on a project-by-project basis, but also it is helpful in the overall implementation of the forest fisheries program.

Fisheries biologists should have a good understanding of the various activities of a proposed project (i.e., timber sale boundaries, road layout, proposed grazing, etc.). Aquatic resources associated with a proposed activity must also be identified. This might include type of fishery, value/use of fishery, PETS species, population density, biological significance, downstream effects, magnitude of fishery involved, fishery objectives, etc. The biologist should review a specific site to obtain any needed information on the resource and on the project proposal and then evaluate their expected interactions Any potential conflicts should be determined and noted. Biologists are encouraged to work closely with other resource specialists during the evaluation process.

The written report should fully describe the aquatic resources involved. Any concerns the biologist may have identified should be clearly stated. Finally, include any recommendations that would help the ID team. The report should be factual, accurate and be written so it could be easily understood by the nonbiologist. Avoid technical jargon and nonessential data.

Biologists should periodically monitor project sites to evaluate or improve any models used. This is an opportunity to update and refine recommendations.

EXTERNAL COORDINATION

Several laws govern various facets of the Forest Service's fisheries programs and activities. The major laws are the National Environmental Policy Act (NEPA), Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and the Endangered Species Act. These laws are administered by various Federal agencies, all of which must also observe the Fish and Wildlife Coordination Act. This act allows the U.S. Fish and Wildlife Service to provide comments and recommendations about fish and wildlife resources that could be impacted by proposed projects.

A public disclosure of impacts that are anticipated from the various types of Forest Service land management activities is required by NEPA. Disclosure documents range from decision memorandums for projects that will result in minor perturbations, to environmental impact statements for projects that will result in major perturbations of the environment. In all cases, documents are circulated for review and the fisheries biologist may be asked to coordinate input on forest fisheries resources from the public as well as State and Federal natural resources agencies. Coordination with the Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, State water quality control agency, State wildlife and fish conservation agency, and the State natural heritage agency may be required by NEPA.

Section 10 of the Rivers and Harbors Act of 1899 requires that anyone proposing modifications to a navigable waterway obtain a permit from the U.S. Army Corps of Engineers. Section 404 of the Clean Water Act, also administered by the Corps of Engineers, requires a permit to place fill material in wetlands Section 10/404 permits are required for many Forest Service projects including some fish habitat management projects involving instream structures. Applications for Section 10/404 permits will usually be reviewed by the Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service (in coastal areas), the State fisheries agency, the State water pollution control agency, and others. An exception to this would be if the proposed work is covered by a general permit in which case no permit application is required. Proposed projects on navigable waterways or wetlands requiring a permit should be closely coordinated with the Regulatory Functions Branch of the local Corps of Engineers' district office as well as agencies that will be reviewing the permit application. Pre-application coordination with the above agencies will increase the likelihood of expedi-

tious permit application processing and approval.

The Endangered Species Act is administered by the U.S. Fish and Wildlife Service. This act protects species that have been determined to be in danger of extinction. The protection encompasses these species' habitats. Coordination with the U.S. Fish and Wildlife Service varies considerably. Only informal consultation may be needed on projects that may have a very slight possibility of impact on species listed as threatened or endangered. On the other hand, in-depth input may be needed for critical projects being implemented specifically to meet a need identified in a species recovery plan. State sensitive species lists usually have no bearing on Forest Service activities in and of themselves. However, many forests have compiled their sensitive species list to include all Federally listed species, those proposed for listing and some or all species from the State list. State agencies responsible for compiling the State sensitive species list vary among States, but usually the State natural heritage agency is responsible for the listing of sensitive plants. Sensitive animal species may be the responsibility of either the State heritage agency or the State fisheries agency. Fisheries biologists have coordination responsibilities involving other agencies that are concerned with the Endangered Species Act. All such matters require that he/she stay in contact with the appropriate State agencies and the USDI Fish and Wildlife Service. For more information on PETS species management, please refer to chapter III.

To be most effective in managing the fisheries resources on the national forests, it is imperative that the biologist coordinate fisheries needs with other resource activities. It is also important that the biologist work with the forest in coordinating activities involving the fisheries resources with other agencies, groups and interests. Internal and external teamwork will result in more productive habitats, healthier fish populations and a better informed public.

CHAPTER VI
COOPERATION AND PARTNERSHIPS

INTRODUCTION

In 1974, Public Law 93-452, commonly referred to as the Sikes Act, authorized $10 million annually to the Secretary of Agriculture for wildlife and fish management programs on lands under his administration. To be eligible for funding, the act requires an approved, comprehensive plan to develop, maintain, and coordinate management activities in cooperation with State wildlife and fish agencies. As a consequence, many national forests prepared strategic and operational plans for the management of fisheries and wildlife resources. These plans, together with the more recent national forest land management plans, highlight goals and objectives for the management of fish and wildlife on national forest lands.

Although these goals and objectives were formulated by the Forest Service in support of mandated responsibilities, for several reasons full achievement is possible only through cooperative efforts with other agencies and organizations. First, with few exceptions, the management of fish and wildlife are the responsibility of the State in which they reside. Therefore, planned activities directly affecting fish or wildlife populations (and communities) must be approved by the appropriate State fisheries agency. For example, our objective may be to enhance a population of brook trout. However, we cannot achieve full success without eliminating competing rough fish Therefore, the State's concurrence is needed. In another instance, habitat improvement may be of little benefit to a brook trout population if harvest regulations allow over-exploitation. In that case, the State's assistance in proposing more restrictive regulations should be sought.

A second reason for cooperative efforts in fisheries is that few agencies have sufficient funds for major surveys. What may not be possible individually can often be accomplished through cooperation. Some help is available through the Wallop-Breaux legislation. This law increased Federal-aid funds for State fisheries agencies to include proceeds from taxes on boats and motors and imported fishing gear. Essentially, the act doubled funding for many States and significantly enhances their ability to enter cooperative ventures.

Finally, cooperative endeavors enhance communication and lessen the chances of groups with common goals taking divergent paths. When groups split, negative issues arise, which necessarily require the expenditure of a very nonproductive resource — negative energy. Actually, cooperative endeavors not only reduce the possibility of disagreement and conflict, they tend to create a multiplying factor that results in bigger and stronger programs as projects naturally build one upon the other.

GOVERNMENTAL AGENCIES

Forest Service. Although fisheries goals and objectives developed at the forest, regional, and national levels are often aimed at improving sport fish populations and angler harvests, the only "unilateral" actions the Forest Service can take involve habitat and access management/ modification/ improvement. Fortunately, those options are among the most productive from a fisheries management standpoint and form the basis for many cooperative partnerships. In such endeavors, cooperators often assist with species introductions, development of new regulations, and surveys and inventories. The important thing is to clearly recognize that other agencies have prerogatives that deserve respect, just as does the Forest Service.

State Agencies. As was mentioned earlier, fish are the property of the State in which they reside. This ownership forms many of the fisheries resource management policies common to most States. Each State structures itself somewhat differently to deal with its fisheries resources and factors that affect them. Typically, there will be a game and fish agency that houses fisheries management and research biologists (usually in regions and districts), hatcheries, and enforcement personnel. In close association, there is usually a department of natural resources that deals with pollution control, water permits, etc. Florida, for example, has three principal agencies with which Forest Service fisheries biologists frequently need to interact. The Department of Natural Resources acts on requests for piers and dredge and fill; the Department of Environmental Regulations deals with water pollution and plant control problems, and Game and Fish Commission deals directly with fisheries research and management. In addition, new funds for fish and wildlife conservation education programs have resulted in substantial State programs, usually administered by the game and fish department or division. The *Conservation Directory*, published annually by the National

Wildlife Federation (1412 Sixteenth Street, NW, Washington, DC 20036), is an invaluable source of information on agency structure and points of contact.

USDI Fish and Wildlife Service. The principal responsibility of the USDI Fish and Wildlife Service related to Forest Service fisheries programs is in the area of threatened or endangered species. Any forest action likely to impact a threatened or endangered species must be coordinated with the FWS. Informal calls to the nearest FWS office to explain specific circumstances should be made without hesitation. The appropriate FWS staff person can then provide relevant advice. Additionally, annual contact is advisable with the FWS official who is concerned with the use of management indicator species (MIS) to monitor threatened or endangered fish species. Remember that the Forest Service and FWS share the same goals for species diversity and the recovery of threatened or endangered species. Frequent coordination and communication will facilitate the efforts and benefit the resource.

Tennessee Valley Authority. As a resource development agency, the Tennessee Valley Authority (TVA) would also be a likely candidate for cooperative projects where Forest Service lands adjoin TVA property or waters. A call to the fisheries laboratory in Norris, TN, will provide contact with biologists with considerable experience in fish, bottom fauna, and freshwater mollusk taxonomy as well as reservoir fisheries management.

POTENTIAL COOPERATORS

Although the discussion thus far has dealt only with State-Federal agency interactions, some of the most valuable cooperators are nongovernmental agencies. Basically, organizations or groups of individuals with a shared interest in fish and fishing on national forest lands constitutes a potential cooperator. Some examples include: Local sporting clubs, Trout Unlimited, Federation of Fly Fishers, Bass Anglers Sportsman Society, Boy Scouts of America, and schools and universities. A review of an annual Forest Service Challenge Cost Share Program report will substantiate the diverse possibilities available for cooperative partnerships.

FACILITATING THE COOPERATIVE PROCESS

The establishment of cooperative partnerships tie closely with program marketing efforts. During the identification of constituents and requests for input for the development of goals and objectives, the fisheries biologist should: (1) examine opportunities for mutually beneficial projects, (2) solicit suggestions on the role that the cooperator would prefer, and (3) develop plans to bring key players together for a more detailed discussion. Other opportunities present themselves at annual interagency program reviews, professional society meetings, fishery workers conferences, and during ongoing challenge cost share project work.

Memoranda of Understanding (MOU) are valuable assets to have available during program and partnership building. An example of a MOU is given in figure 2.This MOU provides a statement of organizational intent and interest and provides some guidelines for cooperative participant roles. Such documents prevent the need to "reinvent the wheel" as far as organizational policies are concerned, and smooth the way for discussion of proposals. The place to begin the development of an MOU obviously is with the State fisheries agency because it will be involved in most cooperative partnerships. Regional biologists are ideal contacts since generally they have a very good sense of what is happening "on the ground," but are near enough to upper agency management to know policy and procedures.

After development of a project proposal, ensure that everyone has the same understanding of each cooperator's role in a particular project. Follow the good business rule — **Put it in writing.** Take notes during planning sessions, give all parties a draft copy of the cooperative agreement, however informal, and follow up with a final draft for everyone's files. Finally, always follow project completion with an expression of appreciation. Letters or certificates from the forest supervisor and acknowledgement in the news media are just a couple of means to let partners know they are appreciated.

Figure 2.—Example of a MOU.

MEMORANDUM OF UNDERSTANDING
between
USDA-FOREST SERVICE,
NATIONAL FORESTS IN NORTH CAROLINA
and
NORTH CAROLINA
WILDLIFE RESOURCES COMMISSION,
STATE OF NORTH CAROLINA
and
NORTH CAROLINA COUNCIL,
TROUT UNLIMITED

I. AUTHORITY

THIS MEMORANDUM OF UNDERSTANDING is entered into by and between the NORTH CAROLINA COUNCIL of TROUT UNLIMITED, a citizen's group with fourteen Chapters dedicated to the protection and enhancement of coldwater resources, hereinafter called TROUT UNLIMITED, the NORTH CAROLINA WILDLIFE RESOURCES COMMISSION, acting by and through its Executive Director, under the authority of Article 24, 1947, of the State of North Carolina, hereinafter called the COMMISSION, and the UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE, acting through the Forest Supervisor, National Forests in North Carolina, under the authority of Regulations 36 CFR 241.1 and 241.2 and the Volunteers in National Forests Act of 1972 (PL 92-300), hereinafter called the FOREST SERVICE.

II. INTRODUCTION:

WHEREAS, the COMMISSION manages and regulates fish populations in approximately 2000 miles of perennial trout streams within the State of North Carolina, and

WHEREAS, the FOREST SERVICE manages fish habitat in approximately 2000 miles of perennial trout streams with the State of North Carolina, and

WHEREAS, TROUT UNLIMITED desires to maintain and improve an irreplaceable trout resource dependent on land management practices within watersheds containing trout waters, and

WHEREAS, it is the mutual desire of the FOREST SERVICE, the COMMISSION, and TROUT UNLIMITED to work in harmony for the common purpose of developing, maintaining, and improving the coldwater fishery of the National Forests in the best interest of the people of North Carolina and the United States.

III. TERMS

NOW, THEREFORE, the parties hereto agree as follows:

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Figure 2.—Example of a MOU, continued.

A. THE FOREST SERVICE SHALL:

1. Follow management practices which will protect the water quality and riparian areas within the National Forests.
2. Maintain an inventory of existing and potential direct habitat improvement projects that would improve the coldwater fishery in the National Forests.
3. Construct and maintain stream improvement devices in selected streams to the extent of available funding.
4. Enter into specific collection agreements, volunteer agreements, or contracts with the other parties to accomplish the agreed upon work.

B. THE COMMISSION SHALL:

1. Design and carry out research and survey projects necessary for the management of trout populations.
2. Provide technical assistance to protect and enhance fish habitat
3. Assist in the construction and maintenance of stream improvement devices in selected streams to the extent of available funding.
4. Enter into specific collection agreements, volunteer agree ments, or contracts with the other parties to accomplish the agreed upon work.

C. TROUT UNLIMITED SHALL:

1. Provide labor and materials to the extent of availability for the completion and maintenance of stream improvement projects in the National Forests.
2. Provide manpower for creel surveys and similar types of data collection necessary for management.
3. Assist in stocking streams where stocking is desirable.
4. Assist in other types of projects as needed to inform, assist, and serve the public regarding streamside protection and coldwater fisheries management.
5. Enter into specific collection agreements, volunteer agreements or contracts with the other parties to accomplish the agreed upon work.

D. IT IS MUTUALLY AGREED BY ALL PARTIES:

1. To cooperate in developing, maintaining, and improving the coldwater fisheries within the Nantahala and Pisgah National Forests.
2. To cooperate in collecting data regarding fishing pressure, water quality, and trend of aquatic habitat within the Nantahala and Pisgah National Forests.
3. To cooperate in the improvement of trout streams through manipulation of stream environmental conditions such as cover, pool-riffle ratios, and bank stabilization.
4. To exchange information in matters such as fish research and

- - - continued - - -

Figure 2.—Example of a MOU, continued.

surveys, forest projects which may affect fish habitat, stream habitat improvement, public education, and regulation changes.

5. To meet periodically to discuss fisheries concerns including acontinuing program of work.
6. That nothing in this Memorandum shall be construed as obligating any party in the expenditure of funds.
7. That no Member of, or Delegate to, Congress, or Resident Commissioner, shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.
8. That this Memorandum of Understanding shall become effective upon execution by the parties hereto and shall continue in force until terminated in writing by any party giving 60 days' written notice to the other parties indicating a termination date.
9. That amendments to this Memorandum may be proposed by any party and shall become effective upon approval by all parties.

IV. EFFECTIVE DATE

IN WITNESS WHEREOF, the parties hereto have executed this Memorandum of Understanding as of the last date written below.

USDA-FOREST SERVICE
NATIONAL FORESTS IN NORTH CAROLINA

By_____
Title Forest Supervisor
Date_____

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
STATE OF NORTH CAROLINA

By_____
Title Executive Director
Date_____

NORTH CAROLINA COUNCIL,TROUT UNLIMITED

By_____
Title Chairman
Date_____

CHAPTER VII
PROGRAM MARKETING

INTRODUCTION

Although it is a relatively new eoneept to most biologists, marketing is an essential element to a suecessful program. In the eontext of the Forest Serviee's "Rise to the Future" initiative, the philosophy of marketing the fisheries program centers around satisfying the desires of the fishing public. The ageney has a vital interest in learning what the public wants, and in using the information internally to ereate program direction that will satisfy the fishery elientele.

The Forest Serviee has a service the public wants: quality fishing on the national forests. This demand has been identified through publie response to forest land and resouree management planning, public input to fisheries-related forest activities and through positive feedbaek to past and ongoing fisheries enhancement/proteetion programs. "Rise to the Future" is a program developed in response to a demand for quality fishing. It is the agency's responsibility to market this service, if it is to be fully suecessful.

WHAT IS MARKETING?

Aeeording to Crompton and Lamb (1986), marketing ean be broken down into **agency mission, marketing strategy, implementation and evaluation.**

Mission. In "Caring for the Land and Serving People," the Forest Serviee developed "Rise to the Future," a program that is designed to protect and enhanee the quality of the fisheries habitats. It was also designed to increase fishing opportunities available to the publie.

Marketing Strategy. A marketing strategy is composed of the seleetion of target markets, identifying marketing objectives and establishing a marketing mix. At the national level, the agency has identified the various fishing publies as their target marketing groups. However, each forest will need to identify specifie target groups that are associated with their individual and unique fisheries resourees. Establishing objeetives allows the forest to look ahead and identify where it would like to be in terms of managing its fisheries to meet the public needs. The public, particularly the target groups (partners, constituents and user groups), should be involved in providing input and direetion in identifying these objeetives. This will establish broad ownership as well as ensure that the ageney is providing the public with a marketable serviee.

Marketing Mix. The marketing mix eonsists of the product, distribution, price and promotion. The produet is the fishing opportunities and quality habitats that the public desires from the ageney itself. The mix will vary among forests, depending on resources available, eommunity interests and historieal use. The produet must be available to the user in order to be marketable, and the cost to use the fisheries resources must be publiely aeeeptable. The availability of fisheries serviees on the forests must be eommunieated to the publie through promotional efforts. Of the four elements of the marketing mix, this is the area that generally needs increased emphasis. Promotional efforts are also needed internally to ensure that other funetions of the ageney are aware of the importanee of these services. Not only will promotional efforts inform the publie of the services available, but it will help inerease the public awareness of the important role that the ageney has in fisheries management.

Evaluation. Evaluation is also a necessary eomponent of marketing that measures the degree of user satisfaetional. Feedbaek on program effectiveness ean be measured directly through open communieation with publie user groups or from more sophistieated surveys. Through evaluation, the ageney ean ensure it is meeting the fishery needs of the public, or in short, it ean determine if it is successfully marketing the fisheries program.

MARKETING SERVICES FOR A SUCCESSFUL FISHERIES PROGRAM

A review of important services to be marketed for a sueeessful fisheries program and some strategies to employ should help balance and prioritize marketing efforts.

The Fisheries Biologist. Often overlooked among things most eommonly thought needing promotion for suecess of a venture is the single most important ingredient — the biologist. Many will judge the merit and potential sueeess of a proposal on the impressions he/she makes. Important eharaeteristics of a good program

manager/marketer include high professional standards, willingness to be innovative and take risks, dedication to the tasks at hand, and open-mindedness. This is nothing new and simply says that little things such as how an individual dresses and conducts him/herself during the course of their work and interactions with others can have a significant influence on the success of their endeavors.

"Rise to the Future." The focus of most fisheries program marketing efforts will involve the "Rise to the Future" Initiatives in one level of detail or another. In the broadest sense, the tactic is to increase overall awareness of the importance of managing fisheries on the national forests. To support that initiative, we must market concepts as broad as the value of habitat improvement and protection during multiple resource management. We must also market specific concepts such as the need for improved fishing access on a remote lake. In marketing the "Rise to the Future" initiative, we must clearly show the important role the Forest Service has in protecting and improving fisheries resources on national forest lands and how that contributes toward meeting the public's needs.

Program Progress and Accomplishments. Frequent demonstrations of progress will validate earlier proposals and build support for continuation of some tactics as well as the need for new initiatives. These efforts will also serve to advertise opportunities available to the angling public and others who want to fish on national forest lands.

SUCCESSFUL MARKETING STRATEGIES AND OPPORTUNITIES

Before considering individual strategies, recall the marketing definition offered earlier. Marketing is an integrative and continuous process. Taken as such, marketing should not be a separate project or something forced into plans, but rather should be an integral part of most endeavors. Effective marketing, however, does require planning and a commitment to take advantage of opportunities.

Marketing involves more than selling and requires first of all that we identify potential customers and determine their needs. One of the most important strategies is to explore and develop networks. We must seek the opinions and ideas of State, regional, and district biologists on some of the more important fisheries problems and opportunities on national forest lands. Names of key contacts among angler societies, civic organizations, the angling public and the news media should be identified. The interests and needs of these people should be determined. The biologist has to be available! Inputs from the public, together with statements of need from staff officers and forest managers, will go a long way toward formulating basic program direction. This network-derived information can also be supplemented with opinion surveys that may be available from fisheries extension services, The American Fisheries Society, State fisheries agencies, chambers of commerce and tourism, etc. It is simply easier to market a program based on strong demand; much can be learned by asking the right people.

Having targeted clients and potential supporters, the remaining task is to develop support for fisheries program initiatives. This is best accomplished by communicating program plans and accomplishments to the broadest audience possible, with special emphasis on principal clients. The biologist should be aware that the key internal audience is the forest supervisor. Key external audiences are the publics who can influence him or her. Effectiveness of different marketing strategies will vary according to clientele. Whatever the communication/marketing strategy used, it needs to be very understandable and attract interest. The most important strategy is to assure that fisheries program objectives are integrated into the land and resource management plan. Additional approaches include:

1. **Project/Program Overviews.** These can be presented to Forest Service staff as part of monthly supervisor's office and district employee meetings and should key on major goals and directions. Include enough detail for various staff and employees to see how the plans will involve them. Program overviews can also be an item at angler organization meetings, in magazines, and an invited topic at regional staff meetings of State fisheries agencies.

2. **Fishing Brochures.** Because they can be made available to so many so easily and allow diverse information such as pictures, maps, schedules, narratives, and points of contact, brochures are a must in all marketing efforts.

3. **Project/Theme Videos and Slide Talks.** Videos and slide talks are especially effective means of taking an audience directly to the resource and highlighting a particular theme. They can be used in ID team conferences, for school or civic organization presentations, as part of a chamber of commerce or other visitor center display, etc. Themes around which videos and slide talks can be developed are

almost unlimited and could include things such as "Ecology of a Southern Appalachian Trout Stream," "Improving Bass Populations in Central Florida's Small Lakes," "Cooperative Partnerships on the National Forests in North Carolina."

4. **Angler Society Memberships.** Because some of the strongest cooperators are angler organizations such as BASS and Trout Unlimited, active membership in the organization conveys a message of shared common goals. These groups present many opportunities to market the fisheries program and to advise and lend assistance. Biologists should welcome requests to talk to the groups or individuals. They should volunteer for participation in club activities and **always** be present or represented when the club is working on a Forest Service project. Being a member/worker can provide exceptional opportunities for highly effective, one-on-one marketing efforts. Those who have been there will be quick to admit this involves hard work and a lot of time, but the rewards are worth it.

5. **Technical Presentations and Articles.** The ultimate success of "Rise to the Future" initiatives depends heavily upon continued strong partnerships with State fisheries agencies. By making independent or joint presentations of project results in technical publications and at conferences such as AFS chapter meetings, the Southeastern Association of Fish and Wildlife Agencies annual meeting and State fisheries workers' conferences, partnerships and the value of the work are recognized. In addition, Forest Service fisheries biologists and program goals become better known to colleagues in other agencies and organizations.

6. **Resource Base and Program Accomplishment Data.** The Washington Office of the Forest Service depends heavily upon regional fisheries program managers for data on individual forest resources and program accomplishments. Knowing the number of structures and acres of habitat improved is essential for internal accountability. However, to achieve user satisfaction, the fishing public needs to know what is occurring on the ground as a result of the program. The answer should be given in terms of better and more fishing opportunities, improved habitats and healthier fish populations. In summary form, this data is a powerful tool in persuading Congress to provide continued program support.

7. **The News Media.** Many fisheries projects could attract wide coverage by newspapers, radio and television, but may not be known. Biologists should encourage attention to program activities by arranging tours and inviting reporters known to have an interest in the outdoors to visit a project site. Taking news media personnel fishing and on population inventories can provide payoffs. The same opportunities need not be offered to all media people. The biologist should inquire about those who have shown interest in the past and actively recruit their support. The benefits work both ways since a good story is always appreciated, and often leads to repeat opportunities.

SUMMARY

To effectively market Forest Service fisheries programs, the biologist should consciously apply various strategies mentioned above to all program activities. Marketing is not difficult, but does require the identification of clients and supporters and determination of their desires and expectations during the formulation of program goals and objectives. Fisheries program managers must then effectively communicate their goals and the results of endeavors they and their cooperators have undertaken. The end result will be that more of the public knows the value of fisheries resources on national forest lands and that cooperative partnerships are working toward its continued protection and improvement.

CHAPTER VIII
PROGRAM DEVELOPMENT

INTRODUCTION

Developing and implementing a strong forest fisheries program is an essential step in effectively managing the aquatic resources on the national forests. It identifies a vision as to where the forest should be directed in managing its fisheries resources. It focuses the efforts made by the Forest Service, the States and other partners in making the vision a reality.

In order to develop an aggressive fisheries program capable of meeting current and projected public demands, the fisheries biologist should ask several questions:

1. What does the public want from the fisheries resources?
2. What are the physical and biological needs of the aquatic resources on the forest?
3. Where should the fisheries on the forest be in 3 to 5 years?
4. What steps are necessary to achieve the management goals identified?

To properly answer these questions and build a strong fisheries program, the biologist needs to understand what a program is, and what steps are needed to attain the program.

WHAT IS A PROGRAM?

One dictionary defines a program as any organized list of procedures. To be more specific to our needs, a properly developed program establishes *goals* for fisheries resource management on the forests, goals that are outlined in the forest land and resource management plan, and goals that the forest supervisor, supervisor's office staff, and district rangers can identify with and support. A program identifies funding for surveys and inventories, population and habitat management, and monitoring. Cooperative partnerships between the forest, State and Federal agencies, and public groups may be improved through a properly developed fisheries program. The program should yield reliable information and provide continuity among all of the forest's resource disciplines. The program should be a positive or proactive response to resource needs on the forest rather than being reactive or antagonistic to other resource programs or forest policies. A healthy, aggressive fisheries program gives ranger districts and the forest a positive image that the public can support and to which it can readily relate. A well balanced program can have numerous formats, but regardless of style, it should answer two basic question: (1) *What are the goals* and (2) *What is needed to reach them?*

Several steps or building blocks are needed to design and build the program A suggested format contains goal statements, objectives, procedures and projects, as described in the following sections.

Goals. First, the general direction in which the fisheries program is to be headed must be identified in terms of a goal statement. The goal would be based on the biological needs of the aquatic resources and the public demands for their use. Because of the complexity of fisheries resources on southern forests, a fisheries program will generally identify several goals. These goals provide the foundation or reasons for identifying and accomplishing coordination and project work on the ground level. The establishment of goals by the biologist should include input from the districts, other resource functions, State fisheries agencies, and public user and interest groups. This ensures that all aspects of the resource are represented and encourages widespread ownership. Examples of goal statements may include: "provide the public with a trophy bass fishery" or "manage aquatic threatened/endangered species to ensure their eventual recovery." Goal statements are critical for a well-balanced program and provide management direction that the forest supervisor can use in relating to and supporting the forest fisheries program. Fisheries goals should be outlined in the forest land and resource management plan.

Objectives. The next step in program development is to identify the objectives necessary to achieve the goal(s). Objectives should be quantifiable so that during the monitoring process, it can be readily determined if they have been successfully achieved. They should be reasonable and attainable and should be identified as necessary for achieving forest goals.

Examples of objectives are: "increase the average weight of the bass in the lake population from 0.7 to 1.5 pound" or "increase the catch rate from three fish per 12-hour day to six fish".

Procedures. The procedural step is the actual "how to" step that identifies what needs to be done to complete the objectives in achieving the goal(s). This is generally the level of the program development that the biologist feels most comfortable with. The procedures consider what is needed in terms of enhancement projects (improvement), coordination with other resource activities (protection), surveys (learn better what is out there), fish stocking/regulations (population control) and monitoring (evaluation). This level of program development identifies type and location of project, costs, outputs and responsibilities. This is the level where Challenge Cost Share and other cooperative opportunities should be identified. Projects provide the line officers with a ready reference for implementing work plans identified as necessary for goal/objective accomplishment. Examples of project-level work may include:

Install stream structures for pool development	35 str/mi for 7 mi	$ 350	Biologist/ district
Stocking fingerlings	10 lb/ac for 100 ac/yr	$2,000/yr	State
Inventory	100 ac/yr	$3,000/yr	Fisheries biologist
Provide input into other resource activities (coordination)	3 sales/yr	$2,000/yr	Fisheries biologist

Sample Format of a Program Structure

Introduction
Forest Fisheries Resources
Goal Statement: "Provide the public with a trophy bass fishery in the warmwater lakes on the forest."

Objective (1) Increase the average weight of the bass from 0.8 pound to 1.5 pounds.

Project (1): Fertilize 60 acres at $1,600/yr
Project (2) Install 100 brush shelters at $3,000
Project (3): Survey 100 acres/yr at $2,000/yr

Objective (2): Increase the number of lakes available in the fishing from 7 to 11.

Project (1): Repair dam at Smith Reservoir . . . . . .$ 5,000
Project (2): Develop two new reservoirs . . . . . $20,000 each
Project (3): Stock two existing reservoirs with fingerlings . . . . . $ 2,000

Objective (3): Increase fishing access by 35 percent.

Project (1): Reconstruct 2 miles of existing road $35,000
Project (2): Construct four concrete boat ramps . . . . . .$20,000 each
Project (3): Develop three fishing piers . . . . . $10,000 each

Once the program is identified, incorporate the projects into an implementation schedule in the form of an annual work plan. Prioritize each project and determine the year in which it can be implemented, depending on funding available. From this, program funding needs can be identified in out-year budgets. A flow chart may be helpful:

Priority	Target	Costs	Remarks	Year
Dam repair	1 str	$ 5,000		
Fertilize	60 acres	$ 1,600	Challenge cost share	
Stock fish	110 acres	$ 2,000	State responsibility	I
Inventory	100 ac/yr	$ 2,000/yr	District & SO biologist	
Construct Res. #1	1 str.	$20,000		
Brush shelters	100 str.	$ 3,000	Challenge cost share	
Install boat ramp	1 str.	$20,000	Help from Army Res.	
Reconstruct road	2 miles	$35,000		
Fertilize	60 acres	$ 1,600	Challenge cost share	II
Survey	100 acres	$ 2,000		
Construct Res. #2	1 str.	$20,000		
Construct boat ramps	1 str.	$20,000		
Construct Res. #3	1 str.	$20,000		III

The lines drawn to determine the year in which the project is to be implemented depends on expected funding levels. In this example, project dollars are expected to be $58,000 per year. Several funding levels should be shown.

This is a working flow chart and should be kept flexible. New projects will be identified through surveys, and restoration projects can surface following wet seasons or changes in program priorities. Additions or other changes would all be added to this list in various orders of priorities. All districts should be represented in each year's program to ensure widespread forest ownership. In the event additional money becomes available any

time during the year, the next priority project(s) could then be implemented a year earlier. In the event of a low-budget year, this chart would identify the high-priority projects that should be funded and which projects can wait. Coordination needs with other resource activities should also be included in this flow chart.

Using this procedure, all activities occurring on the ground would contribute to program goal(s) agreed upon by all involved parties.

The development of an aggressive fisheries program will help to establish recommended management direction through the identification of goals and objectives. It also outlines what is needed to achieve the forest's goals in terms of specific projects, coordination needs, costs, and target attainments. A strong program gives ownership, not only to line officers, but to user groups and State agencies. Ownership is critical for obtaining their support, both financially and politically.

A well balanced fisheries program leaves tracks and establishes continuity. It will continue to grow and provide for the resource regardless of personnel changes. It is an important tool that can be used in establishing resource needs and integrating the needs into the budget process. A program elevates the fisheries resource needs within the agency as well as the Forest Service role in fish habitat management within the professional fisheries community.

CHAPTER IX
PROGRAM BUDGETING

INTRODUCTION

Forest Service budgeting is a long time frame process (3 years or more) that may appear complicated because of variable funding sources and work-code priorities. The budgeting process works both from the ground up in the program development process and the top down in project funding and allocation process. The core element of budgeting is the forest land and resource management plan (LMP) and its associated fisheries program goals, objectives, priorities, and projects. The LMP is a combination of multiple resource capabilities, interdisciplinary resource management, public needs and wants, and cooperative partnerships that serve as the cornerstone of development in forest-level budget requests. The process is one of involvement from planning stages to funding legislation, to allocation, and requests for funding and target adjustment to the final allocation.

BUDGETING FROM THE GROUND UP

Ranger District

Ranger district personnel identify resource projects needed to implement the Forest LMP and to manage and protect aquatic resources. The projects and funding needs are cooperatively developed and reviewed by the district ranger and district staff. Development of a budget for a given fish and wildlife project may begin up to 5 years before actual implementation. The longer planning periods are needed when field surveys and improvement plans have not been completed, or are being developed through interdisciplinary action teams. The forest's fisheries biologist assists and advises the ranger districts in workable projects that meet the overall Forest fisheries goals outlined in the sorest LMP. District personnel are responsible for:

1. Deciding what aquatic or fisheries jobs must be accomplished on a yearly basis. This might involve contracting through the supervisor's office and coordination with fisheries and watershed staff.

2. Preparing yearly work plans outlining program and project level needs (targets) and requesting appropriate funds.

3. Cooperatively working with and providing support for the fisheries program, which needs to originate and be supported through the forest's fisheries biologist.

Using fish habitat improvement project planning and implementation on a Forest as an example. The fisheries biologist and ranger district representative would initially determine fish population objectives for an aquatic area. The National Forest Management Act 1976 (NFMA 1976) requires the Forest Service to maintain viable populations of native vertebrates and have them well distributed within their habitats in a planning area. During the forest's planning process, management objectives for fish and their aquatic habitats were established in cooperation with State fisheries agencies and user groups. District personnel in cooperation with the fisheries biologist determine habitat capability of the specific area to meet fish population objectives set during the forest's planning process. During this time, habitat relationships are determined and used to compare species' needs with habitat factors such as food, cover, and water quality. Limiting factors are then identified and improvement needs noted. The size of the project needed to produce the desired results is determined. For instance, number of boulder clusters in a stream to increase pool volume to add 2 pounds per acre smallmouth bass carrying capacity. The cost effectiveness of the project is determined and priority of the proposed project is compared with other proposed projects forest-wide. Funding sources are then identified. Funding may come from a number of sources:

1. Appropriated funds are usually provided to the National Forest System by Congress on a fiscal-year basis. These funds are divided between administration of the program (CI 1) and habitat improvement (CI 2).

2. Challenge cost share funds are a portion of those allocated by the annual appropriation act. Congress, or the Chief, earmarks these funds for coop-

erative habitat improvement programs within the appropriation. The objective of the Challenge Cost Share program is to encourage private groups, State, or other Federal agencies to provide matching funding, in cooperation with the Forest Service program, to increase benefits to fish and wildlife. It provides an opportunity to inform user groups about the Forest Service mission and to engender close cooperative ties with our publics.

3. Knutson-Vandenburg (KV) funds are available from the sale of national forest timber. Their expenditure is authorized by Congress annually. The funds are collected from timber sale receipts. Funds for fish and wildlife improvements are not always available from every timber sale and are restricted to resource improvements or monitoring of improvements in the timber sale areas from which they were collected. Any KV funded resource improvement activity must be completed within 5 years of the closure of the timber sale.

4. Sikes Act funds come from collection of fees for use of Federal lands, and are usually used for habitat management and improvement. Most forests have not taken complete advantage of these funds.

5. Other funding is available through "cooperative funding" for forest projects. These funds come from timber sale proceeds, road users, mineral leases, or groups interested in funding programs on the forest.

District staff and the fisheries biologist should determine the fiscal year in which a specific aquatic project will be implemented. The project is implemented when authorized and funded in the annual work planning process. Effectiveness monitoring is conducted to determine whether the project is meeting objectives identified during the planning process. The project is then modified as needed.

National Forest

While the ranger district plans and implements projects in the field, the supervisor's office, using district and SO staff input, establishes targets and objectives for all of the Districts to meet the forest's fisheries goals. Only a small portion of a forest's fisheries projects may actually be outlined in the forest LMP, but the direction established to attain fisheries goals should be clearly defined. Site-specific projects should meet objectives to achieve the goals set forth in the Forest's Plan. After a forest LMP has been approved, a fisheries action plan should be formulated. This 5- to 10-year plan outlines the fisheries program and details the funding needs. The fisheries program of work should be updated each year. The fisheries biologist is responsible for maintaining effective work planning methods to implement the forest's fisheries action plan. Forest-level fisheries planning and prioritization determines which programs and projects will be scheduled for completion in a particular year. It is critical that all fisheries projects be prioritized for funding during a 5-year planning period. When funding is established, available work can be executed, and targets documented as they are completed.

The forest supervisor assembles proposed budgets of each resource area to implement the forest plan resource area by budget level. This proposal is prepared 2 to 3 years before implementation. Proposed resource area funding levels to implement the forest plan may be higher than the current resource area budget level of the forest due to forest LMP priorities in work area funding. Many projects may be eliminated during the forest's program development process before the forest program budget levels are submitted for approval at the regional level.

Regional Office

The regional forester establishes and maintains management control according to national policies. Proposed budgets from all forests within a region are validated and verified by the regional office staff. The RO staff may question the forest officers about their budgets and make program modification recommendations. Should a forest program budget appear excessive or inadequate, the regional forester will negotiate a change in the forest program. The regional forester and his/her staff may recommend that forest budgets be adjusted to accomplish priority programs or to follow regional program direction. Changes are usually minimal. Forest programs are then consolidated into a regional program with budget levels. The regional program is submitted to the chief's office. This action occurs about 18 months before actual allocation of funds. For example, the regional forester submitted the 1990 proposal to the chief at the same time the region was receiving the 1988 final budget. In the meantime, the 1989 proposed budget was just going to the president for consideration.

Chief's Office

The chief's office sets Forest Service-wide policies. The regional program proposals are consolidated and evaluated based on a national perspective. The chief's office negotiates any changes with the regional forester and submits the national program proposal to the Secretary of Agriculture where negotiations may continue at the national level. This becomes the agency budget request.

Secretary of Agriculture

The Secretary of Agriculture sets national policy for all USDA programs and determines the appropriate mix of programs, outputs, and funding for all agencies within USDA. USDA, like other agencies, has a constrained budget level and distributes funding among several agencies, including the Forest Service. The Chief of the Forest Service must convince the Secretary of Agriculture that the budget has merit. Adjustments to the agency budgets are often influenced by public interest groups. After negotiation with the Chief, the Secretary of Agriculture presents a proposed budget to the Office of Management and Budget (OMB). This proposal, called the Department Estimate, is given to OMB about 1 year before the start of the effective fiscal year.

Office of Management and Budget

The OMB works with the USDA to compile a budget for the President. When complete, this document is called the President's budget and is submitted to Congress for approval. The President's budget, also called the initial budget, designates allocations to the Forest Service, regions, and forests. The proposed budget usually goes to Congress about 9 months before the effective fiscal year.

Congress

The presentation of the President's budget to Congress begins weeks and months of negotiations and hearings on the distribution of dollars to programs. Appropriation committees and subcommittees for the House and Senate, and eventually a conference committee, consider the proposed budget along with user-group inputs and recommend a budget to Congress. The budget, once approved by the Congress, becomes the appropriation bill and goes to the President, where it is either signed or vetoed. Although the fiscal year begins October 1, the appropriation bill is often not signed for 2 or 3 months into the new fiscal year. In the meantime, new fiscal year Forest Service work programs are started at the funding levels established in the President's or initial budget. Funding for special initiatives such as Challenge cost share, threatened and endangered species management, or anadromous fish habitat improvement or restoration are often earmarked within the proposed budget. These earmarks are the result of input from user- and special-interest groups either through subcommittee hearings or directly through a legislator and may result in additional funds, often called "add-ons." A final budget is allocated to the Forest Service, then regions and forests based on PD&B budget level information and congressional direction.

BUDGETING FROM THE TOP DOWN

Congress. Once the appropriation bill for the fiscal year is signed by the President, it becomes the appropriation act, and the budget becomes established.

Chief's Office. The chief's office allocates funds based on program budgets, congressional direction and overall program objectives. Congress appropriates funds by line items and the chief is authorized to allocate the funds to regional foresters along with any needed direction to meet the intent of Congress. This generally takes a few weeks after the appropriation bill is signed by the President.

Regional Forester. The regional forester allocates funds to the forests and issues implementation instructions. Each forest is given a budget and direction package. Targets are assigned that identify the outputs each forest is assigned to produce. For fish and wildlife, these targets are identified as numbers of acres or structures. Budgets should closely follow the proposed budget but may vary depending on changing conditions or directions from Congress.

National Forests. National forests manage available finances (forest budget) according to direction, laws, and regulations within approved budget proposals and land management plans. Funds are distributed according to approved projects. Generally funding is not sufficient to implement proposed projects so priorities must be established. The forest's fish and wildlife plan plays an important role in determining which projects will be conducted. If special programs have been identified by Congress, these will guide priorities. Challenge Cost Share is an example of such a program.

Ranger Districts. The ranger districts secure on-the-ground program accomplishments. Projects conceived today cannot ordinarily be implemented tomorrow. State agencies, conservation, and user groups may help in prioritizing programs and match funds to already planned programs and specific projects to increase scope and attainment. Ideally, Challenge cost share projects are selected from set projects in the planning cycle. Occasionally, a new project will have a high enough priority to be substituted and completed more quickly. However, these new projects must fit the forest plan implementation schedule.

TARGET REVIEW AND NEGOTIATION

Target review and negotiation to the final budget—the fine tuning process—is generally accomplished by midyear in the budget process. The request for final budget target and fund adjustments are discussed by the regional office staff, and, upon regional forester approval, becomes the new contract for attainment and is reported through the Management Attainment Reporting (MAR) System. The initial budget is usually completed by midsummer. Forests are requested to propose dollar and target adjustments to the initial budget by late summer. The adjustment requests and PB&D information are used to formulate the final budget allocation. The complete process is shown in table 1.

SUMMARY

For the forest's fisheries program manager, the fisheries program budgeting process typically spans at least 3 years (e.g., '92, '91, '90). The Forest Service (Chief) begins a fiscal year budget within the bounds of the President's budget. The President's budget may be less than the previous year's final budget. This smaller budget must pay the same fixed costs, overhead, salaries, equipment, etc.

Congressional action may amend the budget submitted by the President. Congress may increase or decrease funding for resource management. When budget committees start debate, priorities are earmarked within existing funds or funds may be added on. Each area or discipline in the Forest Service usually receives Congressional line item priority. For example, Atlantic salmon restoration on the White Mountain National Forest may be specifically directed by Congress and funds specified for habitat enhancement or stocking. At the forest level, the White Mountain fisheries program manager must have programs that meet objectives outlined by her/his forest's goals and specified by Congress.

Table 1.—Overview of budget process, using FY 1990 as an example

Date	Schedule
December 1987	Forests provide funding needs, by level, (starting point and, usually levels 1, 2 and 3)to the RO for their program needs in the program development and budgeting process. This is the basis of information used to develop the Forest Service's request to the USDA. ☆☆
Summer/Fall 1988	USDA and OMB establish and negotiate USDA budget figures to be used in the President's budget. USDA makes marks on the agency request. OMB marks the USDA request. Administration negotiations occur during the development of the President's (initial) budget.
January 1989	The President's budget (initial budget or tentative budget) is presented to Congress shortly after the State of the Union address, after which the budget figures are officially released to the agency. This may or may not match the original agency request. Administration, or changing USDA or agency objectives may alter program direction and funding. Example: Reforestation of fire-damaged western national forests following the '87 and '88 fire season, and emergency fish habitat improvement as the result of those fires.

— continued —

☆☆— Stars mark those stages in the budget process where biologists should be involved!

Table l.—Overview of budget process, using FY 1990 as an example, continued

Date	Schedule
May 1989	President's budget goes from the WO to RO to the forests. The forests' share is directly related to what their original program development and budgeting requests were. The RO can do some budget balancing at this time. Dollars and targets are allocated to the forests.
Summer 1989	RO responds to the WO (sometimes without forest response, primarily due to timing). This response is made based on RO's understanding of forest needs. Forest responds to the initial budget (President's budget). This response remains at the RO level. ☆☆ The response is in the form of requests for funding or target changes, or both, to the forest allocation of the initial budget. In the meantime, Congress is preparing the appropriation bills. The House and Senate mark up their respective appropriation bills based on effects of lobbying, influence of interest groups, budget constraints, etc. Each chamber passes a final budget bill.
Late summer 1989	The Conference Committee works out the differences in the budget bills between the House and Senate. (Sometimes a compromise between the Senate and House bills, sometimes favoring one side's bill over the other). This adjustment is then passed by Congress and becomes the appropriation bill for FY90.
Sept/Oct 1989	The final budget for 1990 goes out to the Forest Service.The WO distributes the final budget based on: RO Response to the initial budget Special projects and concerns (earmarks) The will of the people as expressed through Congress PD&B data submitted 1 1/2 years earlier.
Nov/Dec 1989	The RO distributes the budget to the forests based upon: Chief's direction Initial program package (PD&B data, Dec. 1987) Forest responses to the initial RO needs
Spring 1990	**Midyear Review.** Regional foresters and forest supervisors can request adjustment in targets and funding (if available) before April 1. ☆☆ Usually, no target adjustments are honored after April 30, unless additional funding is available. Targets become the final contract between the regional forester and forest supervisors.

☆☆—Stars mark those stages in the process where biologists should be involved!

Budget development at the USDA and legislative levels is a very political process. Past budgets have a big influence on future budgets. Congress does not like big changes that occur in a small time frame.

CHAPTER X
FISHERIES SURVEYS

INTRODUCTION

As part of its goals, every forest should establish baseline fisheries information or data that will allow implementation of a fisheries management plan. The plan should be designed to contribute to the Forest Service's management goals and objectives. Continuous updating is required to meet changing habitat conditions and ever-changing management goals.

Fisheries surveys are basic to the establishment of baseline information and must be designed to meet very specific objectives. Surveys may vary from simple, ocular inspections to intensive investigations requiring very precise measurement of all variables in a specific fish community. Program or project objectives will define the type of survey and must be precise, measurable, compatible with goals, and realistic in relation to time, funds, and workforce availability.

Fisheries surveys should meet several basic criteria. First, they should be justifiable, satisfying a recognized need in the management plan, with some form of risk analysis. Surveys should be scientifically oriented, with an objective analysis, and with assumptions based upon clear facts or criteria. Provision for statistical analysis should be incorporated into survey designs when appropriate.

Additionally, measurements and results should be comparable with as many data sources as possible.

The value of survey-derived data is directly influenced by the accuracy and precision of the information collected. Accuracy is defined as how well samples represent the attribute being estimated. Precision, on the other hand, refers to repeatability, and may or may not portray an accurate picture of the overall situation. For example, very precise stream habitat transect measurements could provide accurate results at a selected station, but if all transects fell within riffles, the results could be a misrepresentation of the overall pool/riffle ratio and, consequently, would not be accurate.

SURVEY SAMPLE DESIGN

Although seldom feasible except in habitat surveys, complete or 100-percent measurement of the selected parameter is ideal. If that is not feasible, consider using one of the following sampling designs:

1. **Random sampling**. All units have an equal chance of being sampled, with no bias affecting choice of sampling units.

2. **Stratified sampling**. Sampling units are subdivided into homogeneous groups or "strata". Data are analyzed by stratum, producing more precise results. Random samples can then be selected from the stratified groups.

3. **Clustered sampling**. A large sampling area is divided into clusters of subsamples rather than individual sample sites. Clusters can then be randomly picked. This technique is generally used when the overall sampling area is too large to subdivide into individual random samples.

4. **Systematic sampling**. Cluster sampling in which the same numbered subsample in each cluster is selected.

It may, in some cases, be necessary to subjectively select the sample site. For example, if, for economic reasons, only one or two samples can be collected, it would not be logical to randomly select pool sites that may increase cost due to lack of access or other logistical problems. Monitoring sources of pollution may also dictate subjective site selection. The chance of sampling bias in such situations must be considered, but may be acceptable.

Stream Water Quality. A stream water quality sampling site can usually be selected subjectively. Most changes in parameters are minor and predictable over the course of a stream, reducing the need for many stations. Considerations in selecting station location should include elevation, springflow, development activities, point source pollution, and objectives of the accompanying fish or habitat survey.

Parameters selected for measurements also depend on objectives of the fish or habitat survey. Point source pollution might require measurement of as many as 15 to 20 parameters. Minimum sampling, if not already available from other surveys, should include at least pH, total alkalinity, total hardness, conductivity, and temperature. Flow measurements are also essential in either water "quality" or habitat surveys.

Lake Water Quality. The majority of lentic waters

on southern national forests, not under active monitoring programs by the State or other Federal agencies, are less than 100 acres. Critical elements that should be determined on these waters in a normal management program include:

1. **Dissolved oxygen**. Oxygen profiles should be taken at depth intervals at several locations in the lake.

2. **Temperature**. Temperature profiles are generally taken in conjunction with oxygen profiles. Most lentic waters (especially larger water bodies) stratify and "turnover" only once a year. Small, shallow ponds or lakes exposed to winds may destratify several times a year. Because stratification affects both temperature and dissolved oxygen levels, complete knowledge of these two parameters is of considerable importance.

3. **Exchange rate**. Knowledge of the flow through or exchange rate of a lake is critical in several aspects, including the implementation of a fertilization and liming program.

4. **Total alkalinity**. This simple test provides information needed in implementing fertilization programs and is an indicator of general productivity.

5. **Conductivity**. In lakes or ponds not affected by saline waters conductivity is another indicator of general lake productivity, and also provides criteria for selecting appropriate electrofishing equipment.

STREAM HABITAT SURVEYS

As a general rule, 100-percent measurements are preferable to any form of sampling. A walking (or boating) ocular estimate using a hip chain for linear measurements will, in most cases, provide the best and most accurate picture of overall habitat conditions, at less cost than designs relying on precise transect sampling.

Modifications of the basin wide survey technique used by the Southeastern Forest Experiment Station could be applied to most water types. Their basic habitat types are pools, riffles, and complexes (a group of pools and riffles too small to separate). The observer starts at the stream mouth, moving upstream, measuring each pool and riffle with a hip chain, and numbering them consecutively. Observers validate ocular estimates at every fifth pool and tenth riffle with a taped measurement, thus building a correction factor for each observer. Average and maximum depth of pools, dominant substrate, and amount of large woody debris is also measured.

For use in the Southern Region, validation measurements could be somewhat less stringent. After familiarization, one measurement per 20 ocular estimates may suffice in diverse or complex habitat. Further breakdown into runs, glides, flats, and various "type" pools may be desirable to meet specific objectives. As a minimum, measurement of gradient, flow volume, pools, riffles, complexes, substrate type, and large woody debris separated into "overhead cover" and "other" should be adequate.

Generally, it is unreasonable to expect field units to have the money or staff to complete "basin wide" surveys on most large drainages as a single project. A more reasonable approach would be to arbitrarily divide all streams on the forest into reaches, using changes in gradient, tributary junctions, or other criteria, to delineate the section. Individual reaches can then be surveyed and microhabitat delineated, as needed.

Equipment needs for stream habitat surveys are relatively simple. For long distances, a hip chain is required for linear measurements. For short distances, a 30-meter (98.4-foot) fiberglass tape will suffice, and can also be used for width measurements. Where many fairly precise width estimates are needed, or where water depth impedes movement, the Sonin 250 or other distance-estimating equipment can be used to advantage. A 2-meter (6.6-foot) section of PVC pipe marked off in metric units can serve to measure depth and width of small streams, as a level rod and as a staff to aid in traversing perilous footing. A hand level can be used to acquire valuable data on gradient. Finally, some type of permanent station marker should be carried to establish specific locations of each sample site.

LAKE AND RESERVOIR HABITAT SURVEYS

Along with general watershed data, lake surveys should include morphological characteristics, area, depth measurements, vegetative conditions, and substrate conditions. A description of the type water release structure (surface release, subsurface release, etc.) should be included.

Sonar equipment is excellent for depth and general morphological measurements. David Wergowski, a Southern Region hydrologist, also developed a unique

and useful technique for taking transects for area and volume estimates in small inaccessible ponds (see R-8 Improvement Suggestion No. G003). Aerial photos, maps and survey equipment for triangulation can all be used for acreage and distances.

STREAM FISHERIES POPULATION SURVEYS

Population surveys differ from habitat surveys in that it is seldom feasible to measure the entire fish population in extensive areas. A sampling design should be selected that will, as closely as possible, depict the overall population characteristics in the area worked. See comments in the section on "Survey Sampling Design."

Fish distribution (qualitative) surveys can be very simple, requiring minimal time, labor, and equipment for the area sampled. Electrofishing gear (boat or backpack, or both) is generally the equipment of choice, although seines, snorkeling gear, and others work well in certain conditions. A combination of several types of equipment and techniques produces best results. Hook and line sampling is quite effective in determining distribution of species susceptible to lures. Within reasonably wide confidence limits, this technique can be used as an index of relative abundance.

Quantitative sampling is much more difficult, time consuming, and costly. The additional information gathered is essential, however, to implementing most management plans. Initial surveys for large geographic areas where little or no information is available will, in many cases, be qualitative in nature because of time and money constraints. Succeeding sample efforts should be quantitative in nature where possible.

Toxicants such as rotenone, Antimycin A, sodium cyanide and cresol provide the best estimates of total population. Rotenone is the most commonly used toxicant. It is relatively inexpensive, safe to use, and is effective on all fish species. Concentrations of 0.5 to 1.0 mg/L for short periods of time are toxic to most fish. However, some species such as shad succumb at much lower levels, and a few (bullheads, etc.) require as much as 3 to 4 kg/L. Rotenone is also an insecticide and may kill many aquatic invertebrates. The most effective temperature range for rotenone application is above 60°F; therefore, sampling is usually limited to summer months.

Antimycin A is used in a similar manner to rotenone but is more selective, more expensive, and more critical to apply (PPb instead of ppm). Because of its more selective qualities, Antimycin A may be more important as a population management tool than as a sampling tool. Cresol (USP coefficient 30) is another good tool for quantitatively sampling in small streams. Chance of fish kills from overdosing is far less than with rotenone or antimycin A because it requires about 12 ounces per CFS for a 500- to 600-foot sample. Cresol is a strong acid and requires caution in transport and use.

Sodium cyanide may be used only by trained persons licensed to use this product.

During chemical sampling, use blocknets to impede movement of fish from the area being sampled. Hold the blocknets in place by spanning the stream with a light cable (1/8 or 3/16 inch) attached to a small handwinch on one side to provide tension. Then connect the top of the net to the cable with snaps. Attach the bottom to stakes driven into the substrate or weighted with small boulders.

Use 5-gallon buckets with spigots to dispense the toxicant into the stream just above the sample area. These buckets can be suspended on another cable, or placed upon rocks or logs at strategic points. Rotenone will provide good results when applied at an appropriate concentration for 15 minutes.

Water flowing out of the test area must be detoxified when either rotenone or Antimycin A are used. This is usually accomplished with potassium permanganate. Buckets dispensing the permanganate solution can be suspended or placed on rocks, etc., immediately below the lower net. Dispense the solution into the stream until all traces of toxicant are gone. Dye added during the period the toxicant is added will indicate when the slug of toxicant passes, but will not indicate concentration. Use of conductivity meters and addition of known amounts of an electrolyte (salt) with known amounts of rotenone or other toxicant will indicate toxicant strength at any point in the sample area.

Explosives (primarily detonating cord) are another means of obtaining total population estimates. A positive aspect of this technique is that effects are local with no possibility of downstream fish kills. It is also effective in water too deep to electrofish adequately. Excellent results can be obtained in open water, but obstructions such as boulders and logs tend to shield fish from the effects of the explosion, resulting in an underestimate of the population Because of existing safety regulations, few biologist will have the opportunity to use this sampling technique unless implemented through contract with private groups or individuals.

Snorkeling and scuba diving are gaining popularity as sampling techniques. Snorkeling, in particular, requires only minimal gear. The biggest advantages of this

technique are that there is no impact upon the population being sampled, and census data are generally accurate. A major drawback is the need for a high degree of water clarity. If visibility is less than 2 feet, other techniques should be employed. Lack of qualified observers is another obstacle. Many people are not willing to submerge themselves for long periods, and of those who are willing, few are qualified to identify the fish they see.

Electrofishing will be the most common technique used to assess stream fish populations. A modified method is used where streams are too large to wade with backpack electrofishing gear. Boats mounted with shockers can stun fish in a delineated area over a given time period. This method will provide insight into population structure when used with mark-and-recapture techniques.

When streams are shallow enough to wade with backpack gear, quantitative samples can be collected using either depletion methods or mark and recapture techniques. In two-pass or three-pass depletion sampling, the sample area is blocked off by nets at both upper and lower boundaries. Suspension cables are used for support if necessary (see previous comments.) Establishing a good block net set in some of the larger, rocky, steep gradient streams is a serious problem. Use of an electric seine in such situations should provide a much better impediment to fish movement out of the area. Two or three runs (three preferred) through the area are completed, separating the fish caught in each run. Results are then evaluated by using a depletion formula such as that of Seber and Lecren's (two-step) or Zippin's (three-step), to estimate the population.

The entire fish community is usually measured in depletion samples. Game species can be weighed and measured individually. Other species are usually tallied in total numbers and biomass by species. The smallest and largest specimen of a species group can be individually measured to provide an indication of size variation.

Mark-and-recapture techniques can also be used to estimate populations (usually one or more game species). A simple fin clip suffices in such operations because the recapture trip is usually within a few days of the marking trip. Advantages of this technique are that larger sample areas may be selected, and block nets are not needed. The time spent making three runs in a depletion sample can be spent on one run in a larger sample area. The disadvantage is that there should be at least 24 hours (48 or more preferable) between the marking and recapturing runs. This could be a problem in inaccessible areas.

LAKE POPULATION SURVEYS

In larger lakes and ponds rotenone and boat electrofishing are the primary means of sampling fish populations. Both techniques are covered fairly well in the *Warmwater Streams Techniques Manual.*

Seines can be used to good advantage in assessing pond bass/bluegill populations. A 10- to 15-foot long by 4- or 6-foot high, 3/16 inch mesh seine is pulled through pond margins in early June. The number of fish trapped should indicate spawning success (or failure) by bass and bluegill Young of both should be present for a "balanced" population. A 30-foot bag seine with 1/4 inch side panels and 1/8 inch bag mesh will give additional information about size structure. The seining should be repeated during late summer to verify continuous spawning by bluegill. If no recently-hatched fry are present, some factor (such as overpopulation) is holding reproduction in check.

BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrate or bottom fauna communities can yield important information on water quality. They provide additional estimates of the productive capacity of streams, lakes, and ponds. These fauna include groups such as aquatic earthworms, mollusks (freshwater snails and mussels), and the diverse class of crustaceans that includes aquatic insects, crayfish, and isopods and amphipods. These organisms make up a very significant part of the diet of most sport fish species. Individual species within a given community favor differing habitat conditions and vary in their tolerance to pollution and environmental stress. Therefore, an analysis of the taxonomic composition and abundance of a particular bottom fauna community can be very informative. For example, data on benthic macroinvertebrate populations complements fish and habitat surveys conducted during high-priority MIS monitoring. In another instance, bottom fauna sampling can be used as indicators to determine whether a point source discharge of pollutants to waters on national forest lands is adversely impacting the fisheries resource.

Although benthic ecology can easily be a science in itself, some general statements about sampling strategies may be useful. Sampling is usually designed to occur systematically (e.g., at quarter points along a line transect across a river or stream) or randomly so that every

possible sample point within a sampling area has an equal chance of being chosen. If it is important to isolate the effects of varied habitats on the community, the randomization procedure may be conducted independently on selected strata (stratified random). Some type of randomization procedure should be employed if quantitative results are needed.

Because of the great variability between and among individual samples of any community of benthic macroinvertebrates, a minimum of three samples should be taken at each sampling station. Even then, the precision of the measurement of total number of organisms per unit area will be poor and will probably have a variability ranging from lows of 30 percent or so to highs of more than 70 percent. Number of species can usually be estimated with better precision. Consequently, a word of warning—plan sample designs carefully and interpret the results with caution. The safest (and often most useful) conclusions involve comparisons of relative abundance and taxonomic diversity between streams and sample periods, and dwell very little on absolute expressions of those parameters.

Bottom fauna samples can be taken using devices generally categorized as straining samplers (Surber square-foot samplers, Hess samplers, "D" net, etc.), grab samplers that employ spring or gravity triggered "jaws" such as Eckman, Ponar and Orange Peel samplers, or artificial substrate samplers such as rock filled "bar b q" baskets, or square plates with measured surface area separated by spacers on a rod. Generally speaking, a Hess or Surber sampler is very effective in small streams or riffle and shoal areas less than 18 inches deep (preferably less than 12 inches), in larger streams and rivers. In lakes and ponds a grab sampler is usually most effective.

For more information on habitat requirements, taxonomy, and sampling of benthic macroinvertebrates, refer to Weber's manual, to Hynes, and to Brigham, Brigham and Guilka in Literature Cited; these are especially useful references.

CAUTION

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals — and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Note: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

CHAPTER XI
FISHERIES HABITAT IMPROVEMENT

INTRODUCTION

The goal of fisheries habitat improvement activities is to enhance overall fishing opportunity and quality. These improvement activities should be designed to meet specific objectives that are stated for each species or community affected. For example, certain types of structures may fulfill a fish's requirements for escape cover, but have no effect upon spawning needs.

The intensity and breadth of development projects depend on public demand, biological need, physical characteristics of the site, economic feasibility, and availability of funds. Project design should not be limited strictly by existing techniques. When proven designs exist, use them, but consider new and innovative efforts when conditions warrant.

Complete an analysis of factors limiting fish populations before starting any habitat improvement program or project. If feasible, give first priority to correcting the most critical limiting factors. As these needs are satisfied, other factors will become limiting and should then be addressed

REPRODUCTION

Reproduction must be adequate to replace and sustain population levels commensurate with the overall capabilities of the habitat. In nutrient-poor systems with limited production capabilities, such as Appalachian trout streams, only a small fraction of the reproductive potential is needed to sustain the fishery. Conversely, in a bass-bluegill pond system where the bass depend on sustained bluegill reproduction throughout the growing season, maximum reproduction is essential.

Stream Trout

Reproduction is probably not limiting in most national forest trout streams in the South. However, a few streams or sections of streams, carry such a heavy bedload of fine sediments that trout spawning is minimally successful. Major efforts in these situations should be directed toward treating the source of the problem, including overall watershed and streambank stabilization. The dirt and gravel roads throughout the drainage are generally the main contributors of sediment. Of these, the system roads under an intensive maintenance program of ,frequent grading and pulling ditches are the worst offenders. Minimizing grading intervals, keeping ditches vegetated, and generous use of gravel or even paving in critical areas should significantly reduce sediment input

Structures can be installed to scour accumulation of fine sediment from sections of stream where there is little or no Forest Service control of the upstream watershed. Various types of deflectors or channel constrictors are normally used to narrow the stream and speed the current, thus removing fines from suitable spawning gravel.

A secondary benefit of such structures, even in relatively clean streams, is the back eddies created below the structures. The relatively still water, with its accumulation of leaves and other organic debris provide ideal fry habitat, especially in the shallower areas. This type habitat, also important to the food base, is scarce in many Appalachian streams.

Where stream gradient is steep enough that substrate consists primarily of bedrock and/or boulders, with little or no gravel in extensive reaches, reproduction could be limiting. Log dams (wedge, K-dam, etc.) breaking gradient and allowing deposition of suitable gravel at frequent intervals should ensure at least a few suitable spawning sites.

Returns on project investments can be dramatic, especially if existing conditions are extremely poor. For example, if siltation is so severe that reproduction completely fails, structures used to expose spawning gravel could account for the rejuvenation of an entire fish population.

Stream Bass

Siltation can reduce smallmouth bass populations. Shoal bass and redeye bass (*Micropturus coosae*) have similar habitat requirements and should react similarly to increased sedimentation. Spotted bass and largemouth bass appear to tolerate fines somewhat more than do the other black basses.

The effects of siltation or sedimentation are complex, and little published data specifies whether primary impacts are on spawning (reproduction), food supply, cover, or other factor. All stream basses do require a firm substrate for spawning. Although gravel is preferable, spawning sites can be located even on clay outcrops.

Deep fine sediments can severely limit or prohibit spawning efforts. Bass fan their nests to keep the eggs free from fines, but their efforts are often ineffective in streams carrying a heavy bedload of fines. Methods and approaches similar to those used for stream trout can be used to reduce stream bedloads.

Bass prefer to locate nests near logs or other form of escape cover. Addition of cover logs or trees in potential spawning habitat could help ensure adequate spawning. Recent studies on smallmouth bass have shown that most reproduction originates from a relatively few nests. Providing additional spawning habitat can optimize chances of male bass attracting females to a nest.

Other Centrarchids

Stream Centrarchids other than Bass. Reproduction for these species is not usually a major limiting factor on national forest streams. Response to siltation, however, would be similar to that of the basses. However, escape cover adjacent to spawning sites doesn't appear to be as critical as with the basses.

Pond and Reservoir Centrarchids. A firm, gravel spawning substrate is preferable for all game species of centrarchids. If spawning appears to be a limiting factor, the addition of pea-sized gravel at selected locations is a feasible and accepted habitat improvement technique.

Bass tend to spawn near cover in large, clear reservoirs. The addition of logs or trees in areas lacking such cover can enhance reproduction. Brush piles, although suitable for other purposes, are probably not desirable as spawning cover. Some studies have shown increased predation of bass eggs by bluegills when dense cover is located near the bass nest.

Fluctuating water levels during spawning periods can also be limiting, especially when nests are exposed or when water becomes so shallow that the male must move off the nest. Allowing reservoirs to reach maximum pool, and holding at that level until the eggs are hatched and fry acclimated, will ensure optimum reproduction.

FOOD

The general objective should be to increase the food base to the point that it is not the primary limiting factor, while striving to maintain reasonably natural conditions.

Stream Trout

Self-sustaining Appalachian trout populations are limited mainly to streams above 1,000 feet in elevation. Most of these streams are mineral- and nutrient-poor and, correspondingly, have low fish production potential. Total alkalinity and hardness are generally less than 10 to 15 mg/L; conductivities range from 10 to 25 S/cm. Few streams sustain as much as 40 kg/ha (35.7 lb/acre) of trout standing crop. With basic productivity so low it is especially important to maintain optimum substrate conditions. Infiltration of otherwise ideal mixtures of gravel, rubble, and boulder substrates reduces already limited production capability. Greatest returns will therefore result from techniques used to reduce stream siltation, i.e., erosion control, bank stabilization, and improved road management techniques.

Because of steep gradients and past, poor management practices, Appalachian streams are severely lacking in large, woody debris and fine organic material. Log structures provide substrate and create eddies rich in fine organic material that add to the basic productivity. Any techniques developed to add and stabilize significant amounts of organic material in place will likely increase productivity.

In addition to the use of structures and large, woody debris to trap leaves and other organic materials, supplemental feeding can be a very efficient means of increasing trout production. Standing crop of trout in streams normally supporting 15 to 30 kg/ha (13.4 to 26.8 lb/acre) can be increased tenfold or more. Rainbow and brook trout that seldom exceed 12 inches under natural conditions will grow to several pounds in weight and will exceed 20 inches in length following a supplemental feeding program and restrictive harvests.

Stream Bass

Stream bass conditions in the South run the gamut from very productive hardwater habitats in Arkansas to sandy, infertile Coastal Plain streams containing few, if any, bass. Upper Piedmont and foothill streams draining the Appalachian and Blue Ridge mountains at elevations less than those sustaining reproducing trout populations are more productive than the upstream waters, but are relatively infertile when compared to the more nutrient-rich streams in the Valley and Ridge provinces. The rocky substrate in Arkansas, Kentucky, Virginia, Alabama (Talladega and Bankhead Forests), North Carolina, South Carolina and Georgia foothill streams provides diversity and a degree of productivity not found in Coastal Plain streams. These streams, however, lack large woody debris and other organic material. Addition of significant amounts of such material to the aquatic ecosystem would, as in trout waters, help to increase fish populations.

Sandy Coastal Plain and lower Piedmont streams depend much more on large woody debris and fine organic material for fish production. Studies have shown 70 percent of the fish food production depends on woody material in the stream. Spotted bass and largemouth bass found in these streams should respond very favorably to increases in woody debris in such streams.

Bass do not respond directly to supplemental feeding, although benefits can be derived through increases in the forage base. At present, supplemental feeding as a habitat improvement technique for warmwater stream fish is probably not feasible.

Other Centrarchids

Stream Centrarchids other than Bass. All stream sunfish and most other species should respond to organic inputs as well as or better than the bass, because they feed directly on the invertebrates that use the organic food base. Little literature is available regarding supplemental feeding of sunfish or other panfish in streams. At present, demand for this type of fishery is not great enough to justify such a program.

Pond and Reservoir Centrarchids. Largemouth bass/bluegill fisheries in the South respond very well to fertilization. The primary critical fertilizer element in most waters of this region is phosphorus, with nitrogen limiting only after phosphorus needs are met. Mud in these ponds and lakes is normally acid and strongly absorbs the introduced phosphorus, making it unavailable for developing phytoplankton growth. Bicarbonates necessary for photosynthesis are also lacking. Both conditions can be alleviated by applying agricultural lime to reduce the acidity of bottom muds. This step frees the phosphorus, and raises the bicarbonate ion concentration in the water. Bicarbonates in southern ponds are measured by total alkalinity titration. For optimum results, total alkalinity should be at least 20 mg/L, although some benefits will likely occur at concentrations of 10 to 20 mg/L. There would likely be little or no benefit from fertilization at alkalinities less than 10 mg/L.

LIME

Specific lime requirements can be ascertained through analysis of pond soils. Collect mud or soil from several locations (shallow and deep) in the pond. Then mix and send to a laboratory for analysis. Auburn University and several other land-grant universities offer this service. The laboratory will recommend the amount of agricultural lime needed to satisfy lime requirements.

Agricultural lime is usually applied in the fall. Fertilizer is applied in the following spring. If hydrated lime is used, apply it a week or two in advance of fertilizer application. In ponds with little water exchange (watershed to lake ratios of less than 20:1), one agricultural lime application should suffice for 3 to 5 years. Where ratios are greater than this, and excessive water exchange is a problem, hydrated lime can be substituted. Hydrated lime should be used with caution. Application rates will usually fall between 20 to 60 pounds per acre-foot rather than 1 to 3 tons of agricultural lime needed per acre. Rates for hydrated lime can be calculated with the following formula.

- Determine increase in alkalinity needed; your goal should be at least 20 mg/L (0.25 oz/gal).
- Multiply increase needed by factor of 1.5.
- Multiply results by 2.7 (Pounds of hydrated lime/acre-foot = 1 mg/L) to get the application rate in pounds per acre-foot.
- Finally, multiply the calculated application rate by the acre feet of water to be treated.

Example: 5-acre lake averaging 3 feet deep with total alkalinity of 10 mg/L.

Solution: Goal is to increase alkalinity to 20 mg/L.

- 10 (increase in alkalinity) x 1.5 = 15 mg/L.
- 15 x 2.7 pounds of hydrated lime = 40.5 lb/acre-foot*.
- 5-acre pond averaging 3 feet deep = 15 acre-feet.
- 15 acre-ft x 40.5 = 607.5 pounds of lime for entire pond.

FERTILIZER

After lime requirements are met, apply fertilizer periodically throughout the growing season. This work should begin in March or April, depending upon latitude. Liquid polyphosphate fertilizers with a 10-34-0 or similar composition are generally best. Apply 5 to 20 pounds per acre, depending upon intensity of the program. A rate of one gallon (12 pounds) per acre is a recommended starting point. Once a plankton bloom is established, add fertilizer only when secchi disc readings exceed 24 inches. Readings should range between 18 and 24 inches for best production in shallow ponds. If liquid fertilizer is

* Do not exceed 70 pounds per acre-foot and treat only half the pond at a time as a safeguard against oxygen depletion.

not available, triple superphosphate can be substituted at a rate of 9 to 18 pounds per acre. Production in a normally infertile pond can be increased from as little as 70 kg/ha (62.4 lb/ac) to as much as 300 to 400 kg/ha (268 to 357 lb/ac) with a properly conducted fertilization program.

FEED

Supplemental feeding can also dramatically improve largemouth bass, bluegill and catfish growth rates. Although largemouth bass do not consume the feed, they benefit indirectly since they prey upon bluegills, which will eat the feed. Maximum returns will result from a combination of fertilization and supplemental feeding program. Considering fishing values, benefit:cost ratios can run as high as 20:1 in favor of the project.

COVER

Nearly all fish species in national forests in the South have a need for some type of cover or shelter. A few species, such as catfish and walleye, are light sensitive and rely on depth or overhead cover, or both, during daylight hours. Others use cover only as an escape mechanism. Stream fishes use "resting" cover as a means of conserving energy rather than wasting it swimming against swift currents. Cover can be as small as a piece of gravel creating a resting area for a small darter. Or, it may be as large as a log jam, providing hiding and resting areas for several sizable brown trout. The objective should be to provide the specific type cover required by targeted species, at a determined, critical life stage. These considerations would fulfill all habitat needs within the species' feeding and resting home range. The retention of a natural appearance should be given high priority in all cover enhancements projects.

Stream Trout

All three species of stream trout respond positively to installation of cover in deficient systems. The most dramatic increases have been documented in hardwater, nutrient rich, streams with limited cover and deep water. The State of Wisconsin has recorded as much as several hundred percent increases in both numbers and biomass of brook and brown trout after the addition of various forms of cover. Most significant improvements have been in increases in the number of catchable-size trout. Preliminary evaluation in several southeastern streams indicate potential for increase in all three species of trout, although at a lower level than in the more productive north central streams.

Most southern streams have inadequate overhead cover, deep water, and resting or "holding" areas for adult fish. Other than food, these criteria appear to be the major limiting factors. The lack of large, woody debris due to removal of a high percentage of the large trees along streams in the early 1900's, and the later, misguided emphasis on stream "debris" removal, resulted in extensive stretches of shallow riffle habitat with few meanders or pools. Evidence remains even today of the use of some stream channels as roadways in the initial logging operations. These reaches commonly contain no pools. Such habitats generally support excellent populations of small, but few catchable fish. The solution is to add boulders, log structures, or trees in these sections. The resulting pools and overhead cover should lead to an increased harvest of larger fish.

Bedrock substrate is prevalent in some streams. This situation can also be improved by adding structures. Bedrock reaches often have adequate depth for large fish, but no holding areas sufficient to keep fish from being displaced during high flows. The addition of logs, trees, and rootwads greatly enhances fishery potential in such areas. These structures create holding areas and provide substrate for food organisms. Where water depth is insufficient, create pools by blasting, and then add cover, if needed.

As a general rule, added cover will benefit fish in large streams — those 25 to 30 feet or more in width. Trees, rootwads, and large cover logs anchored in place will provide all the necessary cover. Where available, large boulders also serve well. Structures will also help on smaller, low- to moderate-gradient reaches. Cover logs, deflector-cover logs and other types of channel constrictors usually provide the greatest benefits there

Dam-type structures, such as wedge and K-dams, should be limited to use in moderate- to high-gradient reaches of the smaller streams. These structures are especially effective in streams that carry low volumes of water. The dams facilitate the maximum scouring needed to maintain an adequate depth of pools.

Stream Bass

Add woody material for use by smallmouth bass, shoal bass, redeye bass, and spotted bass in rocky foothill and piedmont streams. The response of these fish will be similar to that of trout in comparable habitats. Little published information is available documenting such response, but the black bass has a known affinity for large, woody material. Therefore, strong assumptions

can be made about the value of adding this type of material even where some cover such as boulders and deep water are available.

Large, woody debris in the sandy Coastal Plain and lower Piedmont streams is more important than any other single structural habitat parameter in any stream fishery. Such debris serves as substrate and the primary food source for fish food organisms. Equally important, it is also the major factor in establishing pools and other forms of cover for most species of fish. Without it, there would be little or no fishery. Although the spotted and largemouth are the only basses found in streams with sand and finer sediment substrates, with adequate levels of organic material, these fisheries can compare in quality to some of the better foothill streams.

As a general rule, habitat improvement in bass streams should be limited to the addition of trees, rootwads, logs or bundles of logs, and boulders.

Stream Centrarchids other than Bass

All sunfish employ escape cover in a fashion similar to that of the black basses. Rockbass, shadow bass, and warmouth however, prefer overhead cover, and are seldom found far from it. Rockbass, as implied by their common name, and shadow bass are most common in rocky boulder-strewn reaches with undercut banks and abundant, large woody debris. Warmouth, on the other hand, are most often found in muck or other fine sediment substrate with similar overhead cover requirements. Green sunfish are only a notch below the above three species in requirements for cover.

Redbreast and longear sunfish occupy similar habitat within their given ranges. They are probably most similar to the black basses in cover requirements, other than having less stringent requirements for spawning cover.

All sunfish will respond positively to the addition of cover. As with bass and trout, it is possible to significantly increase the numbers of catchable sunfish by installing suitable cover. The greatest potential for gain is in the shallow, sandy Coastal Plain streams.

At present, demand for fishing in moderate to large size streams containing both bass and sunfish is great enough that cost:benefit ratios should support habitat improvements. In small headwater streams (with the exception of redeye bass streams) with limited bass potential, cost:benefit ratios for such projects is questionable.

Pond and Reservoir Centrarchids

Maintain cover, including macrophytes, for the maximum production of bass-bluegill populations in ponds and small lakes, especially during a fertilization program. The reduced visibility created by the plankton bloom serves as a form of cover. Any additional escape cover could reduce the efficiency of bass predation to the point of creating overpopulation by bluegills. Vegetation control is, in fact, very important in managing these ecosystems. The use of white amur (grass carp) is an effective alternative and, in most cases, the most economical long-term solution to vegetation control in southern ponds.

Larger reservoirs and some of the natural lakes in Florida may contain little structure or vegetation. Cover added in the form of brushpiles, tire reefs, logs, trees, etc. is very desirable under those conditions. Whether these structures simply attract fish or actually increase production is questionable (probably a combination of both).

Whatever the case, studies have shown significantly higher concentrations of bass, bluegill, crappie, and channel catfish occur in and around such structure than in surrounding areas devoid of cover. In the cooperative study on Barkley Lake (Kentucky), tire attractors contained, by weight, four times more channel catfish, 15 times more bluegill, 20 times more largemouth bass, and 14 times more white crappie than did control areas. Brush attractors were even more effective, holding three times more channel catfish, four times more bluegill, two times more largemouth bass, and three times more crappie than even the tire attractors.

Assuming conservatively that only one half the above figures are true production or standing crop, extremely strong justification for cover/attractor projects in situations delineated above seems to exist. In large reservoirs, even with no additional production, concentrating fish for more efficient harvest is well justified in many cases.

CHAPTER XII
FISHERIES HABITAT RELATIONSHIPS

INTRODUCTION

The Forest Service's Fisheries Habitat Relationships (FHR) program is a national effort designed to explore the relationships between terrestrial and aquatic environments. The goal is to integrate fisheries habitat inventories and evaluations into project- and forest-level interdisciplinary resource planning and management.

To ensure continued high-quality fisheries stewardship, the technical transfer component of the FHR program supplies fisheries biologists with the latest in technical tools to manage the aquatic resources. The FHR program, the aquatic portion of an overall National Wildlife and Fish Habitat Relationships (WFHR) program, began in the early 1980's (Nelson and Salwasser 1982). The direction of the WFHR program to manage habitats on Forest Service lands for a full variety of wildlife and fish resources, was established by Congressional mandate. The WFHR Program includes: (1) Protection for species sensitive to land management practices, (2) habitat improvement for population recovery of threatened and endangered species, (3) habitat enhancement for the production of game and commercial species, (4) protection for species of high public interest.

This mission is carried naturally through the Forest and Rangelands Renewable Resources Planning Act, National Environmental Policy Act, National Forest Management Act, and Forest Land and Resource Management Plans. Nelson and Salwasser (1982) believed the national effort to be a coordinated development of regional, State, or area WFHR programs.

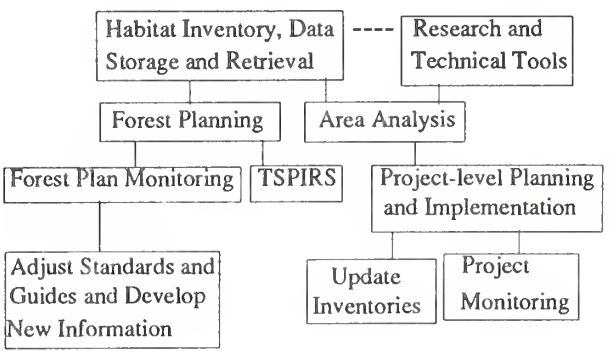
Species-habitat relationships models, habitat evaluation procedures, and a research and monitoring program to develop, test, and refine species-habitat ecology knowledge and procedures are integrated within the program. National wildlife and fish habitat relationship program goals are derived directly from legal requirements and procedural needs at the project and national forest levels.

Parsons (1984) described FHR elements as dealing with: (1) land-aquatic classification, (2) systematic inventory, and (3) fishery production models developed and tested within the Forest Service. Sites located throughout the National Forest System were selected to test the hypothesis that: lakes and streams draining lands that have been formed by similar processes will be similar in fishery production potential and react the same to specific management practices. This testing hypothesis in theory said that inferences on fishery potentials and responses could be extended to classified land-aquatic system units, facilitating integration processes.

The early FHR system developed and tested systematic inventory techniques to monitor aquatic habitat changes and establish a standard aquatic data base for predictive model development. Emphasis was placed on proper fishery planning, standardization of inventory techniques, and consistent data collection and storage. From 1982 to 1984, data collection in the FHR format was conducted at six national sites. When correlated, the results were considered too site-specific and intensive to provide a national framework. In 1987, the FHR direction changed to a more holistic approach examining entire drainage-basin processes.

FHR DIRECTION

The current national FHR framework is based on fisheries resource planning and may be diagramed as:



Current emphasis of the FHR program is the implementation of the forest plan to determine if standards and guides are adequate to protect the aquatic/fisheries resources, and to define data needs for the next effort of area analysis. The regional goal is to integrate fisheries habitat inventories and evaluations into project- and forest-level interdisciplinary resource planning and management. Because the region is nearing completion of the forest planning process, the biologist needs to examine the plan, focusing on area analysis and compartment prescriptions. From a fisheries perspective, biologists should: (1) define aquatic issues, (2) set fisheries objectives, (3) conduct aquatic inventories, (4) examine

alternative developments, (5) analyze and evaluate fish habitats, and (6) monitor the fishery resource. Questions that the biologists need to ask/answer are how, why, and when. Interaction with other inservice resource disciplines, outside user groups and the general public is critical.

ELEMENTS OF FHR

Systematic Basinwide Inventories. Basinwide inventories, using standard techniques, will improve the quality, efficiency and consistency of data collection. Properly conducted basinwide surveys will provide a "snapshot" of conditions within a basin under a variety of management strategies. Once in place the inventory data will be cornerstones for cumulative assessment techniques, monitoring activities and program development.

Land-Aquatic Classification. Integrating fish resource planning with other resources improves the reliability of predicting effects of management activities on the fisheries resource. To be most effective, complete integration of fisheries information into the land management planning area analysis is essential.

Limiting Factor Analysis. Assessment techniques to identify target species and physical factors that most likely limit production should be developed and implemented. This should be viewed as an interactive process that involves the current condition of the habitat, needs of the organisms, and the potential enhancement possibilities.

Regional Fisheries Action Plan. In 1987, the Southern Region submitted a fisheries action plan as part of the Chief's direction. The document provided direction for the long-term management of the fisheries resource on the forests within the region. The region plan followed the format outlined in the national plan and maintained continuity necessary for tracking accomplishments. The regional plan is divided into five major categories and 36 separate action items.

The Southern Region's Fisheries Action Plan provides for a means to accomplish many FHR goals. Specifically, the plan is designed to: (1) improve technical capabilities to maintain and enhance all fish populations, (2) increase emphasis on the fisheries resource, (3) increase public and in-house awareness of fisheries values, (4) increase fisheries expertise on the forests through biologist training, (5) elevate the profile of the Forest Service's role in fisheries management.

Forest-level fisheries action plans should follow the region's format, and incorporate FHR program direction items in many sections. Compared to the regional plan, forest-level plans should be more site- or project-specific and be oriented toward local needs and opportunities.

CHAPTER XIII
MONITORING PROGRAM

INTRODUCTION

Monitoring of Forest Service activities is directed in the National Forest Management Act (NFMA) 36 CFR 219.12(k),. The purpose is to determine how well objectives have been met and how closely management standards and guidelines have been applied. Specific requirements for fisheries management activities are described in 36 CFR 219.19(a)(6):

> Population trends of the management indicator species (MIS) will be monitored and the relationships to habitat changes determined. This monitoring will be done in cooperation with state fish and wildlife agencies to the extent practicable.

In addition, Southern Region directives require that each monitoring plan (1) be adequately documented, (2) concentrate on high risk, big pay-off items, (3) use existing programs, (4) employ an interdisciplinary approach, and (5) involve the public.

TYPES OF MONITORING

Monitoring is a vital link in the adaptive management process that should provide adequate information to prepare attainment reports, check compliance and standards, and adjust management activities. The Forest Service recognizes three types of monitoring.

1. **Implementation Monitoring.** Implementation monitoring determines if plans, prescriptions, projects and activities are implemented as designed. It also checks how well they comply with forest plan objectives, requirements, and standards and guide lines. Evaluation of the findings from implementation monitoring may require adjustments of prescriptions and targets. The findings may also reveal a need for changes in plan or project administration.

2. **Effectiveness Monitoring.** Effectiveness monitoring determines if plans, prescriptions, projects and activities are effective in meeting management direction, objectives and the standards and guidelines. Evaluation of the results of effectiveness monitoring is used to adjust forest plan objectives, targets, prescriptions, standards and guidelines, conservation practices, mitigation measures, and the other best-management practices. The findings could result in change to, or amendment of, the forest plan.

3. **Validation Monitoring.** Validation monitoring is designed to ascertain whether the initial assumptions and coefficients used to develop the forest plan are correct. Another purpose is to consider whether there is a better way to meet forest planning regulations, policies, goals, and objectives Evaluation of this type of monitoring can result in amendments of forest plans. The findings may be used to recommend changes in laws, regulations, and policies that affect both the plan and the project implementation. Specific objectives are established once the type of monitoring program has been determined. Regulations 219.19 (k) (l), require monitoring to provide "quantitative" estimates of performance. Variables or parameters to be measuredshould be selected that will enable the Forest Service to answer questions regarding management indicator species, their habi tat requirements and diversity trends.

OBJECTIVES — WHAT SHOULD BE MONITORED?

Monitoring of the fisheries resource is designed to evaluate and determine whether the forest plan objectives are being met. Therefore, monitoring should be conducted to track (1) habitat trends and (2) populations of management indicator species (MIS). Monitoring procedures should be species-specific, with forests documenting detailed monitoring procedures for each MIS selected in the forest planning process. Details are needed covering: sources of data, determination of adequacy of baseline information, methods of data collections, suitability of data to statistical analysis, methods of statistical treatment of data, cost estimates for data collection and analysis, personnel sources and time requirements, precision and reliability standards, frequency of measurements, reporting interval, and quantitative measures representing significant deviations from present or projected output levels.

MANAGEMENT INDICATOR SPECIES — WHAT IS MIS?

Selected species that are believed to exhibit population changes that indicate effects of management activities have been established as Management Indicator Species.

Population estimates and habitat trend data and information must be maintained for each MIS by the Forest Service. Monitoring to develop population and habitat trend data should be planned and conducted cooperatively with the appropriate State fisheries agencies. Other cooperators and volunteers may help as conditions and work demands allow. To develop monitoring approaches and establish priorities in monitoring efforts, it is useful to categorize MIS into three groups:

1. **Demand Species.** Monitoring intensity and procedures should be designed to provide moderately to highly accurate estimates of population and habitat trends for demand species. Demand species are generally sport fish in high public demand, i.e., bass and trout. Output levels are established in forest plans for habitats capable of producing the kinds, and quantities, of demand species common to an area. Most forests have developed habitat capability models (HCM's) that estimate the output per unit of habitat type. These models, when linked with inventory data, can estimate habitat and potential populations. State fisheries agency data may be used as a check of estimates from HCM's. Comparison of data from these two sources can serve as a basis for large scale validation of habitat capability models where actual populations are near carrying capacity. State fisheries agency data may be used for population estimates of demand MIS where HCM's are not available.

2. **Ecological Indicator Species.** Ecological indicator species are fish that may be widely distributed throughout the forest and serve as indicators of high quality through their life history requirements (for example, smallmouth bass). Moderate to low levels of accuracy and precision are needed for ecological indicator species where information indicates population and habitat levels are significantly above output levels identified in the forest plan. Some forests have developed HCM's for some ecological indicator species. The models predict pounds of fish per acre They may also estimate potential populations for existing habitat. For those MIS's common to several forests, the regional office will work to coordinate (1) development or refinement of HCM's, (2) monitoring procedures and standards, (3) habitat inventory, (4) data management systems and (5) species information.

3. **Endangered, Threatened, or Sensitive Species.** Monitoring intensity and procedures need to be designed to provide highly accurate estimates of population and habitat trends for species near or below viability levels. For species where little information on population, distribution and habitat associations is available, emphasis should be placed on collection of base line data. Habitat trends should be tracked and population estimates conducted by direct count or mark-and-recapture methods.

PRIORITIES — HOW TO DETERMINE WHAT TO MONITOR

Although it is not practical or necessary to monitor all resources and activities, the parameters to be monitored may be numerous and complex. A monitoring program should therefore be designed to be both efficient and effective by using risk analysis to prioritize items to be monitored. Two factors—cost and likelihood of making an error—must be analyzed to establish the intensity of the monitoring program. Cost may be social, legal, biological, or economical. Cost is considered the consequence to the decision maker, agency or public if an error occurs. Management errors could include the loss of a species from an area (biological and social cost), producing lower levels than expected of a high-demand species (social and economical costs), unnecessarily limiting production of timber or mineral resources (economical cost), or violation of NFMA requirements (legal cost). The likelihood of making an error depends on the accuracy and certainty of information and the complexity of the situation. The intensity of monitoring is therefore determined by the interaction of these two factors. If the expected cost for an incorrect decision is high and there is a high likelihood that the decision could be wrong, a relatively high investment in monitoring is warranted. Budgets can be designed to support whatever intensity is needed. Each plan should identify several monitoring cost levels to consider various funding levels inherent in our budgeting process. Compliance monitoring may be proposed at the minimum budget level, while validation of assumptions used in modeling may be proposed at a midlevel, and accelerated program can be proposed at the higher maximum level.

GATHERING DATA

To prepare the specific monitoring plan, sampling techniques and data requirements must be established. For habitat monitoring, a diversity of remote sensing and on-the-ground techniques are available. These range from the use of LANDSET for monitoring general forest patterns, to the use of STORET for 70 specific water quality conditions. Direct population monitoring or population inferences using HCM's are available for MIS monitoring. Using the HCM to make population inferences is a cost-effective monitoring technique for species with low-to-moderate cost and likelihood for errors. Models verified through a consensus of species experts will generally be adequate for monitoring these species. However, the use of models calibrated with actual population data may be appropriate for some moderate-risk species.

Monitoring of high-risk species requires information on actual populations. In some cases, it may be useful to combine actual population information with inferences from verified HCM's.

Once the general approach for each MIS and standard of monitoring has been determined, the actual habitat and population variables should be identified. Variables in the HCM for MIS form the minimum set of required habitat variables. Other habitat variables may be needed to monitor standards and guides. Population monitoring may use a variety of techniques such as population estimates, relative abundance, condition factors, age and growth, and creel surveys.

ACCURACY AND FREQUENCY OF MONITORING

The accuracy and frequency of measurements are established after the necessary variables are described. This determination should be based on the sensitivity of the estimates to each of the variables, and to the natural variability in space and time of the variable. A general guide is to balance the reliability requirements for a variable with the investment needed to produce that reliability. If very reliable information is needed for a parameter with high variance, a significant investment can be justified to produce that information. However, extremely reliable information may not be available for highly variable parameters at any level of investment. The manager must then accept information with a lower reliability than was specified in the risk analysis. Conversely, when only low reliability is required, investments in the data should be kept low. It is particularly important to recognize that rigorous statistical analysis may not be appropriate to establish trends for all variables. Simple summarizations are often adequate to describe trends or conditions.

Once data requirements have been identified, compare them to existing sources of information to determine how much new information should be collected Among the many existing sources of information for monitoring are the continuing inventories conducted to support timber, range, watershed and fuels management Population and harvest surveys conducted by the State fisheries agencies and the U.S. Fish and Wildlife Service are sources of data on population trends for game, commercial and threatened or endangered species. These kinds of data should be available at low or no costs. While they are valuable sources for monitoring information they may not meet all the data needs. Major deficiencies in existing data for monitoring are likely to be found in: (1) population data for some species of high importance, (2) habitat data on habitat classes or special habitat elements not currently collected in other resource inventories, (3) information on the reliability of the HCM used in planning, and (4) data from which cause-and-effect relationships between Forest Service activities and fish populations cannot be determined.

THE MONITORING REPORT — HOW TO PRESENT RESULTS

The monitoring planning process should include the preparation of a document detailing: (1) the monitoring technique selected for each indicator, (2) the variables for which data are needed, (3) the required accuracy and frequency of measurements for each variable, (4) the sample design that will be used, (5) source of data, and (6) manpower, funding, and responsibility for data collection.

Collect and analyze your data with the use of accepted scientific approaches. Objectivity and careful measurements are required to conduct adequate monitoring programs. Collect data in accordance with procedures specifically described in the monitoring program or by following established, standard procedures that have been properly cited in the plan. To ensure that the monitoring program is properly implemented, all individuals involved in data collection need to know what specific information is needed and the intended use.

Limit your analysis of data to the most simple level appropriate. Basic summation may adequately describe the particular condition and, if so, considerable savings may accrue. However, when complicated conditions exist, or elaborate sampling strategies are needed, com-

prehensive statistical analyses are appropriate. When statistical analyses are included in the monitoring report, pertinent values, descriptions of procedures and proper citations are required. If capability models are used, describe both specific analyses and validation procedures.

Effective reporting and use of the monitoring data is the final step in the monitoring process. Design your monitoring reports to clearly display accomplishments and to indicate how well objectives and standards have been met. Reporting units should therefore correspond to those used in planning documents. Condense your description and reporting of standards to those measurable items that were selected for monitoring. Monitoring reports should provide a clear basis for making necessary adjustments. These changes generally result in one of three actions:

1. **Change in monitoring design or intensity**. A change in the design of intensity of monitoring for a given species or standard is "eeded if monitoring data fails to meet reliability standards. For example, your data may yield inconclusive results, so you cannot report whether a population of an endangered species is staying at, or above, the maintenance level under a particular forest management plan.

2. **Change in Forest management action**. A change in Forest management actions (eg., rate and extent of timber harvest on a forest) may be needed if monitoring data indicate that objectives or standards were not being met. An adjustment of this type would also be indicated if monitoring demonstrated the assumptions used in planning were incorrect.

3. **Change in objectives and standards**. A change in objectives or standards is needed if monitoring shows that objectives exceed the potential of a planning unit or that standards were ineffective or unworkable.

To facilitate these adjustments, monitoring reports must be clear, concise and understandable to everyone. They should meet three criteria: (1) report in the same units that were used in describing plan standards and objectives, (2) contain information on the reliability of the data being collected, and (3) present information on what deviations from expected results are considered to be significant.

SUMMARY

Monitoring the fishery activities under NFMA will provide a check on attainment of standards and objectives. It will test the assumptions used in planning, and will improve communications about the fishery program. Monitoring should focus on MIS and habitats. Use risk assessments to select an appropriate level of monitoring for each indicator. A variety of techniques can be used, including both direct population measurements, inferences from habitat types, and habitat capability models. Carry out monitoring programs in cooperation with State fishery agencies. Carefully design monitoring reports to facilitate attainment reporting and adjustments to management.

Monitoring must have high priority, and be considered a comprehensive forest obligation, not just the responsibility of specialists providing the expertise Limited funds, high resource values, increasingly high levels of resource activities make it absolutely necessary for each forest to ensure monitoring plans are developed to provide all needed information and data, yet be cost effective.

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